for . . .

engineers and contractors controlling the design, specification, installation and maintenance of heating, ventilating and air conditioning.

HEATING & VENTILATING

AIR CONDITIONING

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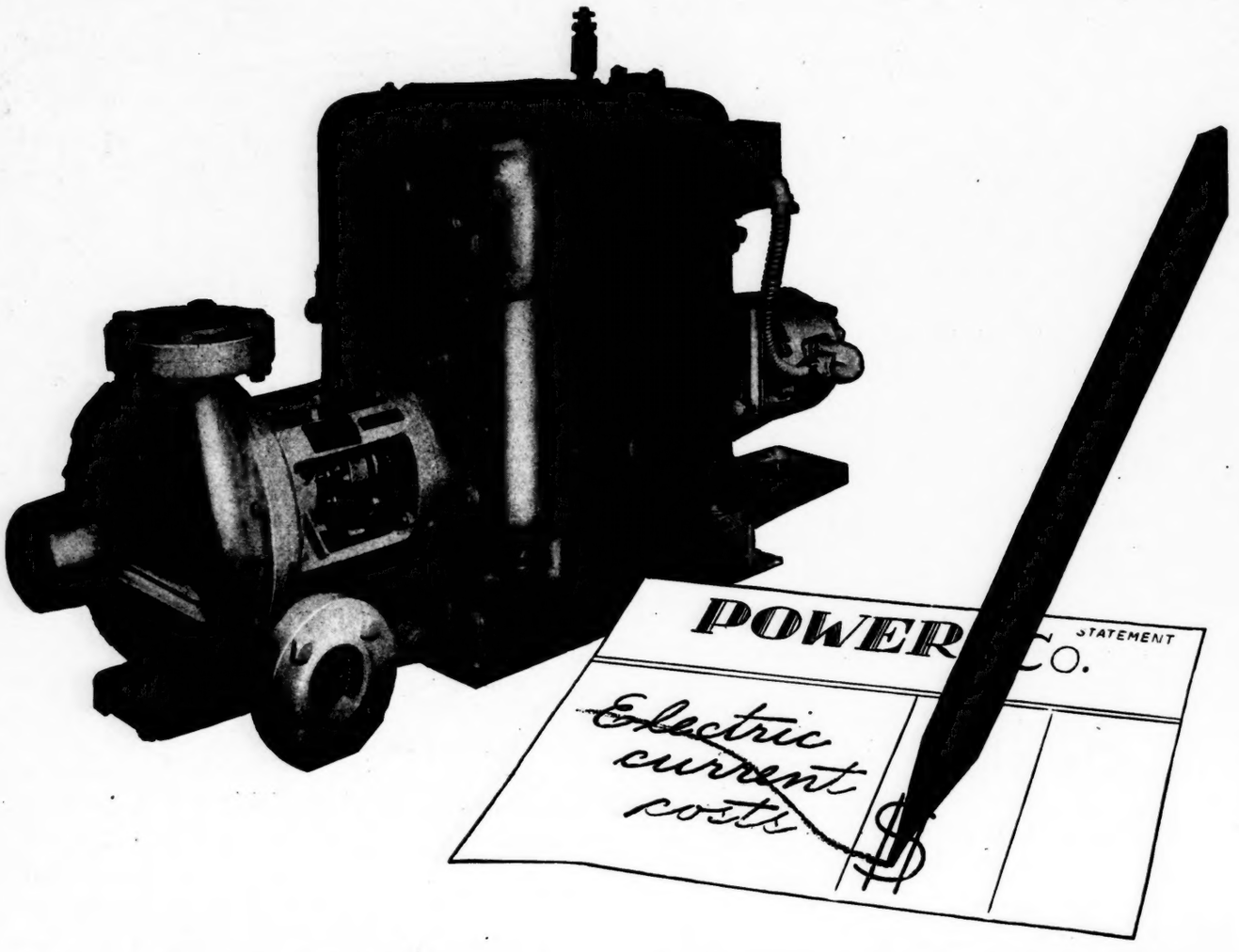
A NASH VAPOR TURBINE HEATING PUMP WILL ELIMINATE THIS EXPENSE ITEM.



The Jennings Vapor Turbine Return Line Vacuum Heating Pump requires no electric current, eliminating the one biggest expense item in the operation of an ordinary return line pump. This is because the motive power is a special turbine operating on steam direct from the heating system. Steam used to drive the turbine is returned to the system for heating, with little heat loss.

The really important saving promoted by the Jennings Vapor Turbine is in the system itself, however, for this is the only heating pump that can operate continuously with economy. Continuous operation means uniform circulation, and uniform circulation means a big saving in steam.

This pump has but one moving part, no internal wearing parts, and no internal lubrication. It is compact and quiet, and will give long and satisfactory service at the lowest maintenance cost. Bulletin No. 246 tells all about it. It is free on request.

THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

AIR CONDITIONING
For Air Defense

SUCCESSFULLY to defend herself against the vicious mechanized attacks of which great foreign powers have lately proved themselves capable, America is mobilizing all her resources. These preparations involve the mobilization of machines to a far greater extent than ever before in history. Consequently, practically all industrial plants are or will be units in the greatest military program on which the United States has ever embarked.

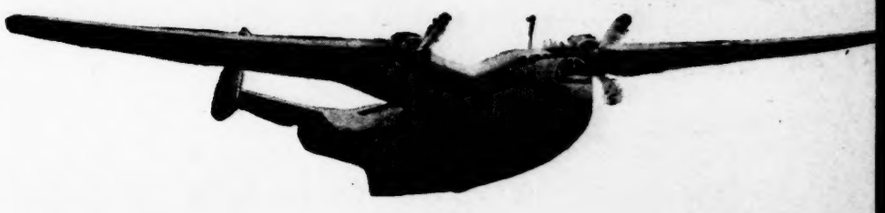
Most spectacular—at least to the layman—of developments in Europe has been the extensive and highly successful aerial warfare. In its way, just as spectacular is the enormous expansion of the aircraft and engine manufacturing plants in this country to supply the Army and Navy with military aircraft. Plant additions to these factories provide for increases of from 50% to 200% of their peacetime output.

Production of this huge number of planes implies proper storage, service, and basing facilities on the part of the air services for whom the planes are built. Both the Army and Navy have already begun, and in some cases nearly finished, great airports from which thousands of planes under production will operate.

All of this construction work is part of a continuous program. A small part is finished; more is under way; still more is being planned. All of it—aircraft plant expansion and air base construction—involves heating and ventilating, and some air conditioning. This being the case, in this issue, on the pages which follow, HEATING & VENTILATING presents case histories of seven aircraft and engine plant additions recently built and of one of the large regional air bases of the Army Air Corps to show its readers current—and probably near future—practice in heating, ventilating and air conditioning in those types of construction which are a part of America's program for AIR CONDITIONING FOR AIR DEFENSE.

In presenting this information, the editors acknowledge with gratitude the exceptional cooperation of the War and Navy Departments; the plant engineers of the aircraft and engine companies, whose plants are here described; and of the engineers and architects associated with the buildings described.

Future developments in industrial plant practice, housing and other phases of defense construction, insofar as they concern heating, ventilating and air conditioning, will be described on these pages in future issues in as comprehensive a manner as is possible considering the restrictions currently imposed on information concerning industrial plants which are vital links in the chain of our defense.



On the final assembly floor of Plant No. 2, Boeing Aircraft Company, a floor unit heater is located on the rear wall to the right of the center in the background.

Designing INDUSTRIAL PLANTS FOR DEFENSE

R. C. FARRINGTON, Chief Mechanical Engineer of The Austin Company, specialists in industrial plants, points out that designing of heating and air conditioning for defense industries involves sound planning as well as speed and economy.

WITH the country on the threshold of a tremendous construction program required to meet the needs of national defense, engineers charged with responsibility for the design of service facilities will have an opportunity to aid in the solution of many challenging problems.

While there is little or no essential difference between the heating, ventilating and air-conditioning requirements for a plant devoted to normal peace-time production and one erected for similar work in conjunction with the national defense program, projects undertaken in the present emergency demand special consideration from many different points of view.

Engineers will have to meet demands for unprecedented speed in the planning and construction of plants and other buildings included in the program with installations which will be adequate, efficient and consistent with the particular operating requirements of each individual structure.

Need for Simplicity

Execution of plans and actual construction will be greatly expedited by the adoption of simple designs, based upon the application of standard equipment and materials. Manufacturers of heating, ventilating, air-conditioning, dust and fume control equipment are now in commercial production on efficient units for almost every type and size of plant, so that special equipment design can be held to a minimum by thorough familiarity with the products of established leaders in this field.

The emergency character of the present program may tempt some owners to attempt to save on equipment. If they realize that labor costs represent the largest portion of expense in any heating and ventilating installation, however, they will not be so eager to take their chances with used, untried or little known equipment, which at best would save them only a small percentage of the over-all investment. Furthermore, unless motors, fans, heating units and all the other elements in a complete setup are entirely adequate and capable of performing in continuous service, embarrassing interruptions are likely to result.

On the other hand, substantial savings can be made by laying out distribution systems along direct routes which eliminate unnecessary runs of pipe and complicated connections. If 40-foot lengths of pipe are used instead of the conventional 20-foot lengths, further savings can be effected by a reduction in the welding required. Where large areas are involved, costs can be further reduced and the installations simplified by the

design of distribution lines and heating elements for moderately high steam pressures which provide sufficient pressure to lift the condensate to overhead return lines. This eliminates the necessity for underfloor returns and permits the use of small diameter pipe.

Sound Construction Essential

Unless proper attention has been given to all the details of general design which influence the extent of heating, ventilating and air-conditioning equipment required, original installation and operating costs will be unnecessarily high. If adequate insulation has been provided and heat reflecting surfaces used on the roof; if monitors, side walls and sash have been designed with a view to reducing the transmission of radiant heat, the problems of maintaining comfortable summer working conditions will be greatly reduced. At the same time, the insulation and all-round weatherproof construction will safeguard against unnecessary heat losses in winter, so that heating expense can be kept down.

In building for the present emergency, it will be well to anticipate the possibility of fuel shortages and to make provision for burning more than one type of fuel. With the wide variety of combination boilers available today, it should be possible to burn whatever fuel best suits the immediate needs of the specific plant and at the same time through a freedom of choice gain the protection against unpredictable price fluctuations and shortages in one type as against another.

Small plants which have no need for boilers and can use direct gas-fired unit heaters to advantage would, at the same time, probably be entirely safe in relying upon their normal suppliers, since their position as defense industries would probably entitle them to preferential status in the event of fuel rationing.

Special Production Aids

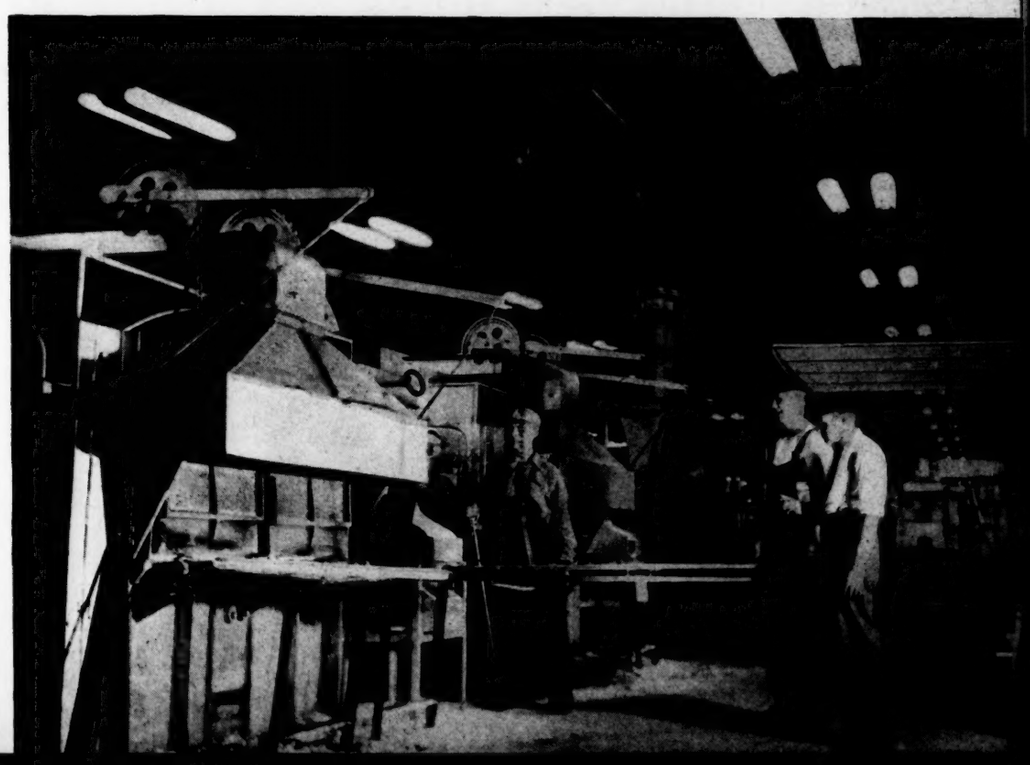
Broad gains have been made in the control possible over heat produced by essential equipment within most plants, giving a substantial impetus to the interest in air-conditioning for structures contemplated in the defense program. The development of fluorescent lighting, for instance, has reduced the heat gain from modern fluorescent tubes to less than 50% of that resulting from Mazda lamps.

While the heat given off by motors and other electrical equipment must be handled as part of the general ventilation problem, the concentrated heat or fumes emanating from annealing and hardening furnaces, tanks or other equipment can usually be disposed of at its source with a little foresight in initial planning. Special ventilating systems, together with modern dust and fume controls, are available for such situations, so that heat treating, pickling, electro-plating, sandblasting and even painting operations can be accommodated in well-integrated production lines. By the intelligent use of such equipment which eliminates the need for detours to isolated departments, designing engineers can expedite production which will be straight-line in fact as well as name.

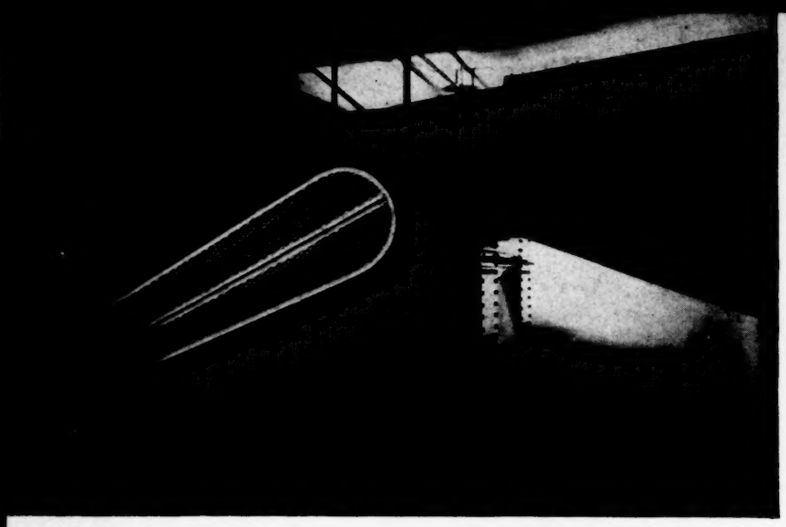
In order to keep service facilities out of the way and at the same time have them readily accessible, many are equipping their plants with underfloor utility tunnels or trenches of sufficient size to accommodate all steam, compressed air, water, power and other service lines. This is particularly true in structures where wide spans make it impractical to locate outlets and piping facilities alongside walls or columns.

Air Conditioning Aid Production

The effect of atmospheric conditions within a plant upon the efficiency of its workers is so well recognized by plant engineers, personnel directors and efficiency experts that it cannot be ignored in any plant devoted to precision work. This is particularly true in the

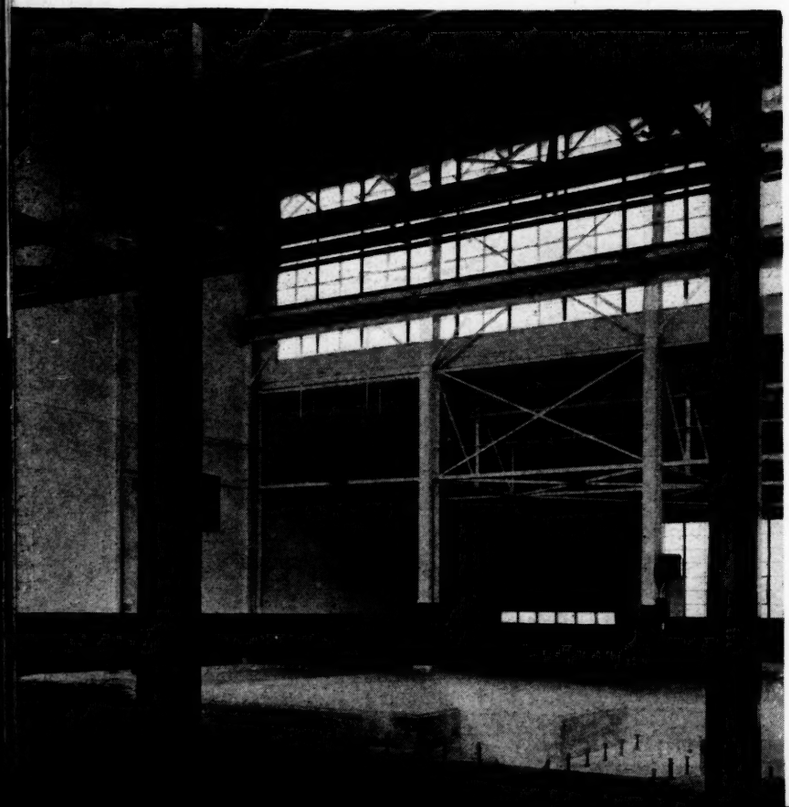


Special exhaust ventilating and fluorescent lighting facilitates air conditioning of plants with a large load from heat treating furnaces.



(Above) The fan for a fume disposal system in a windowless air conditioned plant where heat treating furnaces are in use. (Below) A view of the tunnel for service lines between the boiler house and the plant of the Boeing Aircraft Company.

One of the six blower type unit heaters, each of which delivers 415,000 B.t.u. per hour, seen in the center background in this view of the Cleveland Punch & Shear Works Company's plant.



defense industries, where a limited supply of skilled men and of production tools is retarding the delivery of basic equipment upon which the whole armament program depends.

Where the productivity of men and machines in established plants can be substantially improved by the installation of advanced ventilating systems, air-conditioning or other controls leading to general betterment of working conditions, this should perhaps be the first order of business. In new plants, every effort should be made to insure year-round working comfort, so that employees may function at top efficiency without interruption regardless of the weather.

With persons in charge of the industrial mobilization program favoring the location of new plants for defense industries in the protected mid-continent sector between the Appalachians on the east and the Rocky Mountains on the west, many projects will be developed in an area where normal summer temperatures and humidity would adversely affect production efficiency. This is almost sure to lead to an extensive need for air-conditioned structures, particularly in machine tool, aircraft engine and parts plants, as well as in other precision industries.

While the adoption of air-conditioning will by no means be confined to this area, the immediate need for such equipment will probably be greatest there. Where an adequate, continuous flow of well water is available at low temperatures throughout the year, cooling is possible at low first costs and low operating costs. In some instances such low costs are sufficient to influence the exact location of large plants within a general area. Water used in standing pools or sprayed upon plant roofs can be utilized to offset peak temperatures, whether or not the structure is air-conditioned.

Experience in all parts of the country with air-conditioned quarters for design, engineering, research and general office staffs has long since established the fact that the increased efficiency more than compensates for the expense. In the light of such experience, and the negligible cost of air-conditioning per dollar of pay roll in space used for these purposes, it is reasonable to expect that a large portion of the offices built in conjunction with the defense program will provide for such equipment.

Insofar as the actual layout of air-conditioning equipment is concerned, experience argues for the separation of plant and office systems in the interest of accurate control. In plants where large areas are involved, it is wise to recognize the practical limitations of size in individual systems by splitting the work up between several units of moderate size. This simplifies distribution and gives insurance against total shutdowns when equipment has to be serviced or repaired.

If operating conditions vary from department to department, it is generally advisable to install a number of separate units with automatic controls to meet the exact requirements of each department. Where this is not practical, zones in which the requirements are similar can usually be grouped and satisfactorily served by a common unit.

Assembly Plants and Hangars

Paralleling the need for carefully designed air-conditioning equipment in plants devoted to high precision work are the problems presented in providing adequate and efficient heating and ventilation for large aircraft assembly plants, hangars and other structures where the character of work and the tremendous cubic content per employee makes air-conditioning uneconomical.

The ventilating requirements can usually be met by generous areas of ventilating sash and monitor transoms, since the majority of these structures are either of sawtooth or conventional monitor design and surrounded by continuous bands of sash. In the absence of other roof ventilation, ample provision for the rapid exhaustion of used air can be made by the installation of continuous heat valves or other types of roof ventilators.

All the heating requirements in structures of this type, which sometimes embrace as much as 8,000,000 cubic feet of space in one room, can usually be met by unit heaters of standard design. By installing such equipment with outlets 10 to 12 feet above the floor, uniform distribution of heat can be obtained, even where outlets are lined up 200 to 300 feet apart. The stratification of air is greatly reduced and unnecessary heat loss through the roof prevented if the outlets are located slightly above the working plane and some distance below the roof.

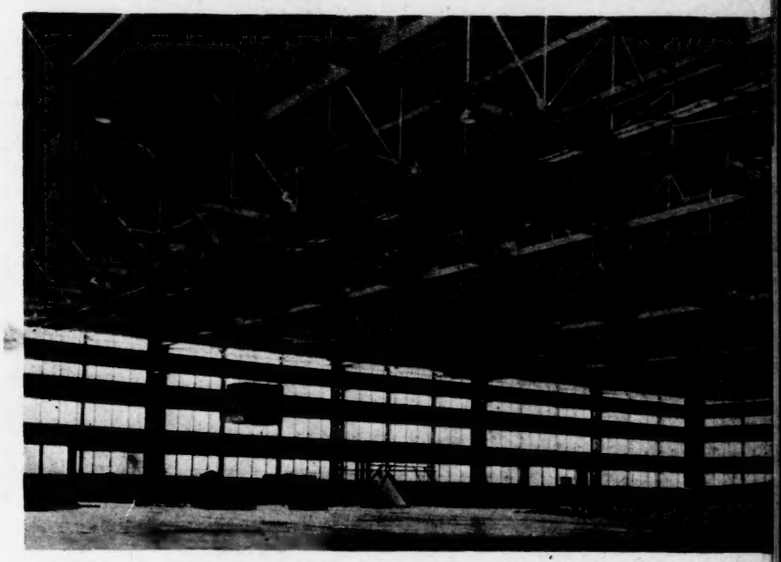
In areas where extreme low temperatures are encountered, special problems are presented by the necessity for opening and closing large doors so that big planes can be moved in or out of assembly plants and hangars. Hangars located in areas where temperatures of 30 to 40F below zero are regularly encountered, for instance, use auxiliary doors to keep the cold out of one-half of the structure when doors are opened, and special steam lines under the hangar door tracks to prevent the formation of ice which would impede operation of the doors.

Conclusion

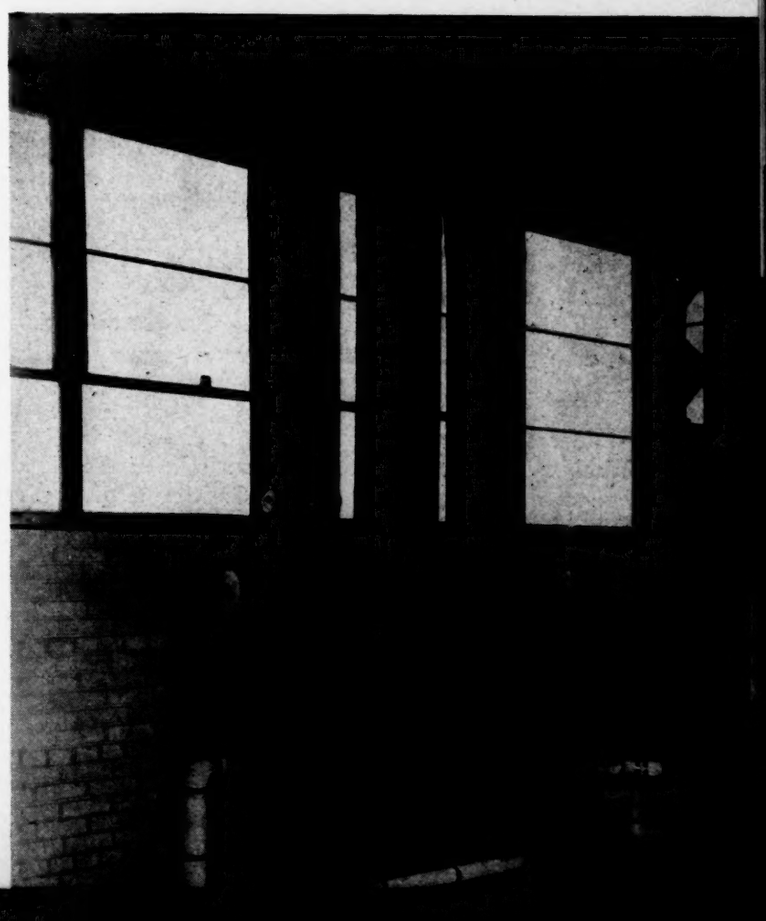
As one surveys the sum total of building activity in prospect from Alaska to the Panama Canal directly traceable to the national defense program—including military housing and general base facilities, as well as air fields and factories — it is apparent that only the industrial plants can contribute in a constructive and lasting way to traditional American progress. They will not begin to meet the accumulated need for modern factories built up by the deferment of plant improvements since the depression began. While some may not be suited to general manufacture, the great majority of plants erected for the production of defense equipment should be adaptable for efficient peacetime use when the *big push* is over.

With most companies thinking of the plants now being built for the defense program as their permanent homes, engineers responsible for the design of service facilities, as well as for the structures themselves, should make them as modern, flexible and efficient as the times permit.

A part of the new 34,000 sq. ft. addition to Cleveland Punch & Shear Works Company's Cleveland Plant. Note the suspended unit heaters at the left.



(Above) A view in Plant No. 2 of the Boeing Aircraft Company in Seattle. Note the floor type unit heaters along the far wall. (Below) One of the 12 blower type unit heaters in the initial unit of the Boeing Aircraft plant. This unit delivers 45,000 c.f.m.



Airplanes of the 17th bombardment group on exhibition on dedication day at McChord Field, July 4, 1940.

U.S. Army Air Corps
McCHORD FIELD

one of the world's largest military airports is of interest to heating and ventilating engineers because of its $600,000 central heating plant and because it will probably serve as a model for airports constructed under a $200 million military airport expansion program. Because of the size of this field the description of the equipment was prepared by three authorities — Major E. P. Antonovich, Construction Quartermaster in charge of construction, Walter S. Leland of the Walter S. Leland Company, contractors for the central heating plant, and J. W. A. Drummond, Mechanical Inspector, Constructing Quartermaster's Office. The entire heating system was designed by the engineers of the Construction Division of the U.S. Army's Quartermaster's Department. Lists of equipment and contractors are given at the end of this article.

CONSTRUCTION OF McCHORD FIELD

By MAJOR E. P. ANTONOVICH†

Under a special act of Congress, the Secretary of War was authorized to establish air bases in six strategic areas in the United States for the operation of General Headquarters Air Force.

ONE of these bases, designated for the Northwest, was subsequently located in Pierce County, Washington. This base, named McChord Field in honor of the late Lt. Col. W. C. McChord, a distinguished Air Corps Officer, was the first of these to get under way.

McChord Field covers an area of approximately 2,000 acres, of which 989 acres, formerly comprising the old Tacoma Airport, were donated to the Government by the citizens of Pierce County. Additional land lying to the South was purchased by the Government, thereby bringing the field contiguous to the 62,000 acres of the Fort Lewis Reservation.

After completion of surveys and studies of the various engineering problems encountered, actual construction was begun in August, 1938. The completion of the essential elements now makes possible the operation of the field as an active air base.

The flying field proper, which lies to the north of present Military Road, is comprised of the runways, taxiways, hangars, warming aprons and fueling station. Just south of the flying field are the heating plant, warehouses, garages and other industrial buildings. To the south of the industrial section lies the Administrative area, barracks, officers' quarters, and recreational areas.

There are four runways in the landing field so laid

†Construction Quartermaster, in Charge of Construction, McChord Field, Washington.

out that take-offs and landings may be made in any direction. The principal runway, lying northeast and southwest, the direction of the prevailing winds, is one of the longest in the United States. From a point about two miles to the southwest on the center line of runway No. 4 extended, is located a radio station from which a beam may be transmitted to aid in landing ships during low visibility.

Four hangars arranged in two groups have been completed. Each group occupies an area of about 300 ft. by 700 ft. On sides and ends of hangars are offices, laboratories, shops, storage rooms and other installations for Air Corps operations. On top of hangar No. 3 are located the control tower, camera obscura and meteorological station. Extending across the front of the hangars is a concrete warming apron, approximately 600 ft. wide by 2600 ft. long. This apron, which provides space for warming up of planes, will permit the securing of ships by means of mooring anchors.

The enlisted men's barracks, accommodating 1300 men, is one of the largest and most modern in the country. The consolidated mess, 80 ft. wide and 220 ft. long, an unusual feature in barracks construction, has capacity to feed the entire command and at one sitting.

Utilities to provide for the present requirements and for future expansion have been constructed. The electric distribution system consists of a substation, underground distribution and street lighting, the energy for which is secured from the municipally owned Tacoma Lighting System. The central heating plant provides heat for the hangars, barracks, hospital and buildings in the industrial area. The sewage system extends about seven miles to Fort Lewis and connects to the system at that post. Water is secured from two deep wells on the field with a capacity of 2,000,000 gal. per day.

Other structures completed or under construction are the station hospital, photographic laboratory, fire station and guard house, mild explosive building, warehouses, cold storage plant, maintenance building and bridges spanning Clover Creek. A railroad spur extends from the main prairie line of the Northern Pacific through the industrial section to the terminal in the hangar area. The ultimate development of McChord Field as projected by the present plans will include an administration building, additional barracks, and quarters, a chapel, school, and in the recreational area a theater, gymnasium, athletic field, etc.

During the period of construction this project has given employment to several thousand men, the daily average being about two thousand. To date about five million dollars have been appropriated and spent. With the recent arrival of troops and airplanes, McChord Field now takes its place as a highly important unit in our scheme of national defense.

CENTRAL HEATING PLANT

By WALTER S. LELAND‡

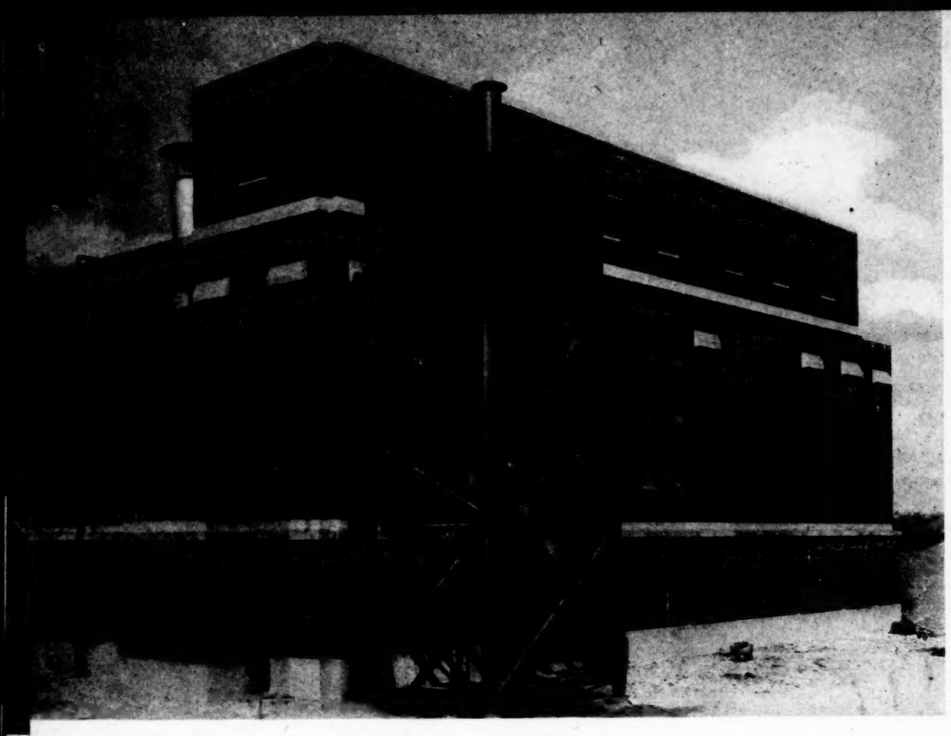
THERE have recently been completed three important cogs in our country's defense mechanism that have received little publicity. They are McChord Field, Fort Lewis, Wash.; Scott Field, Bellville, Ill.; and Chanute Field, Rantoul, Ill. These air fields, especially McChord, are of tremendous importance, defensively speaking, considering the prominent position of the Air Corps in defense preparations.

First of these fields to be completed and dedicated was McChord, located just south of Tacoma, Wash., adjacent to Fort Lewis, the two together forming a powerful Western defense unit. This field, the largest military air field in the world, presently consists of two double hangars, capable of holding eight of the new Army Bombers, known as "Flying Fortresses," two barrack units, warehouses, hospital, refrigeration plant and central heating plant.

This system, designed by the engineers of the Construction Division of the Army Quartermaster's Department in Washington, is detailed with infinite care to provide a power plant as close to perfecton as possible. Equipment furnished at McChord Field, was in

Two hangars at McChord Field. These buildings occupy an area of approximately 300 ft. by 700 ft. The main body of these hangars is heated by four large unit heaters each having the capacity of 1,125,000 B.t.u. per hour.

‡Walter S. Leland Co., San Francisco, Calif., contractors for the central heating plant, McChord Field.



Steam generating plant at McChord Field with capacity of 300,000 lb. of steam per hr. In the foreground is the Allen-Sherman-Hoff cast iron ash tank to which the ashes are blown by means of a steam jet, then removed by truck.

most instances used at Scott and Chanute Fields as well. The designed capacity of the McChord plant is 300,000 lb. of steam per hour, to be generated from four steam generators, two of 100,000 lb., and two of 50,000 lb. of steam per hour.

The steam distributing system consists mainly of a 12 in. high pressure line carrying 150 lb. steam pressure to the hospital, barracks, hangars, etc., at which points the pressure is reduced as required. All condensation is returned to the central plant by means of an elaborate condensate system actuated by motor-driven vacuum pumps which return the condensate to the deaerating feed water heater.

To house the elaborate equipment called for in the design of this plant, a power house of Indiana sandstone and red brick was constructed at a cost of $120,000 representing approximately 20% of the cost of the completed central heating plant.

Fuel Handling

The fuel is coal from the Renton district on the western slope of the Cascade Mountains. Fuel is delivered to the plant by a railroad spur, the cars dumping into a track hopper, from which the coal is carried by an elevator and apron conveyor to the coal bunker. These conveyors have a capacity of 70 tons of coal an hour, equivalent to the contents of three and one-half ordinary coal cars.

The bunker, of the suspended catenary type, has a capacity of 625 tons, equal to about 31 cars of coal. Weigh larries receive the coal from openings in the bottom of the bunker and distribute their supply of coal to the hoppers mounted on the boiler fronts immediately above the stokers. Each larry is supplied with an automatic stamping device which records the weight of coal being fed to the stokers.

The coal bunker is built up of hundreds of small cast iron plates neatly fitted together and bolted so as to breathe slightly as the bunker fills with coal. It is suspended from huge girders by means of iron bands freely hanging as a catenary. When the bunker is full the sides bulge outward and the bottom rises nearly 6 inches above the empty position.

Stokers

Under each of the larger boilers is a six zone spreader type stoker and under each of the smaller boilers a three zone spreader type stoker. Coal is fed to the boilers by paddles which throw the coal evenly over the operating grates, resulting in an even fire. Air chambers and ash pits are zoned so that each coal feeding unit feeds a certain section of grate and this section of grate has one underfloor zone in conjunction with it. Each section of grate is equipped with a steam power cylinder for dumping. The movement of the dumping sections is such that they dump forward, and the loose ash resulting from the method of combustion slides off very easily without any clinker formations.

Each grate bar is suspended in a welded steel cradle, having machined steel trunnions which operate on air cooled, dry, steel ball bearings. The caps of the bearing blocks are of the same tuyere design as the balance of the grate construction, so that the entire projected grate area is uniformly active at all times.

The grates are so designed that no grate bar can break and fall into the air chamber or ash pit and if one grate bar should become cracked, the boiler can stay on a line without interference until it is taken off for cleaning.

Boilers

The boilers are designed for 200 lb. pressure and are of welded construction, bent tube, high head type, utilizing 2½ in. diameter tubes in both boiler proper and water walls. The large unit contains 12,500 sq. ft. of heating surface, of which 10,000 sq. ft. is in the boiler proper.

Operating tests on the boilers included a 24-hour variable load run on each boiler ranging from 50% to 300% of rating, and a 24-hour efficiency run on the large boiler. Based on plant operating conditions, the small boiler produced 62,000 lb. and the large boiler 115,000 lb. of steam per hour. The efficiency obtained at 200% of rating was 83.6%; the theoretical maximum to be expected with the coal as fired was slightly in excess of 84%.

In the acceptance test, one of the larger boilers when operating at 200% of rating showed an efficiency of 83.61% based on an evaporation of 10.26 kB per pound of fuel as fired.

Air for combustion in this system is supplied by two forced draft fans of 40,000 c.f.m. for the large boilers and two of 20,000 c.f.m. for the small units. Three are turbine-driven; one small fan is motor-driven. A dual damper arrangement controls the air supply, one set being on the fan bases, the other at the end of the concrete supply duct in front of the ash pits. The

former is actuated by the automatic control system. The latter is manually operated to shut off the air blast when cleaning out ashes from the pits.

Water is introduced to the boilers by means of four centrifugal feed pumps. Two of these have a capacity of 250 g.p.m. and are turbine driven. Two are half that capacity, one being motor driven and one turbine driven. The motor driven pump is provided with a relief valve by-passed to the pump section, the pump running continuously. The turbine driven pumps are controlled by governors working in conjunction with the thermostatic feed controllers mounted on the boilers to maintain the boiler water at its normal operating level.

Reinjection

Exhaust fan equipment consists of induced draft fans and a recirculator dust collecting system. Gases are taken from the boiler and blown through a centrifugal separator, which takes out the fly-ash and drops it into a dust bin, from which through the operation of dust gates, this fly-ash is sent either to the ash removal system or to the fly-ash reinjection system where it is injected into the furnace and burned.

This reinjection method was used during the tests and was found to add about 1.6% to the efficiency of the boilers. In addition to the fly-ash from the separators, large soot hoppers under the boilers at the bottom of the last pass collect a great deal of the heavier material, all of which passes into the reinjection system.

The reinjection is accomplished by means of two motor-driven fans operating at 9 in. water pressure which are connected to an air header. To this header is connected each soot hopper and each fly-ash chute and the mixture of air and carbon enters the furnace at the rear wall through a special nozzle furnished with the stokers. The introduction of this jet at the rear of the furnace adds to the turbulence of the fire which is to be desired for best results.

Ash ejection is accomplished by raking the ashes out of the ash pits at the rear and over the ash trench in which is installed the ash ejection pipe. The ashes are sucked into this pipe and blown into the ash tank outside the power house by means of a steam jet system. The system consists of an 8 in. heavy cast iron pipe, with inlet tees opposite each ash pit door. The caps on these tees are removed and the vacuum in the pipe accomplishes the desired results.

The cast iron ash tank is set on a steel frame high enough above the ground to allow trucks to drive under, the ashes discharging by gravity into the truck. So completely has the coal been burned that less than 0.2% of the combustible ultimately reaches the ash bin.

Condensate returns are emptied into the deaerating heater by means of motor-driven vacuum pumps. Make-up to the heater is supplied from a water softener.

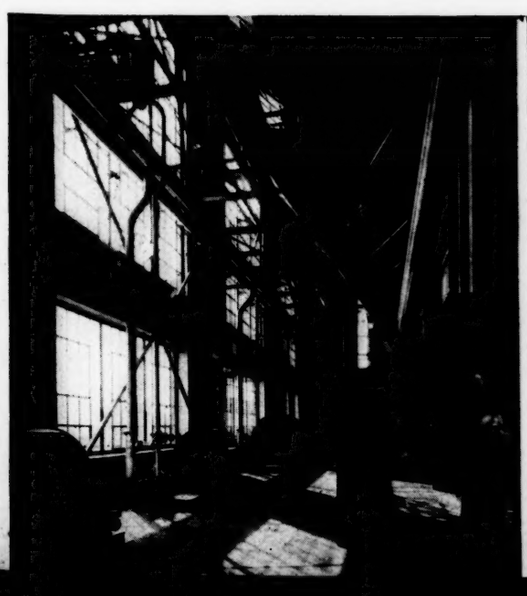
The heater itself, the largest ever built by the manufacturer, is of the metering type. This heater has a capacity of 110,000 lb. of water per hour, and weighs approximately 30 tons. It heats feed water to 212F and removes the oxygen from the water which is otherwise a source of pelting.

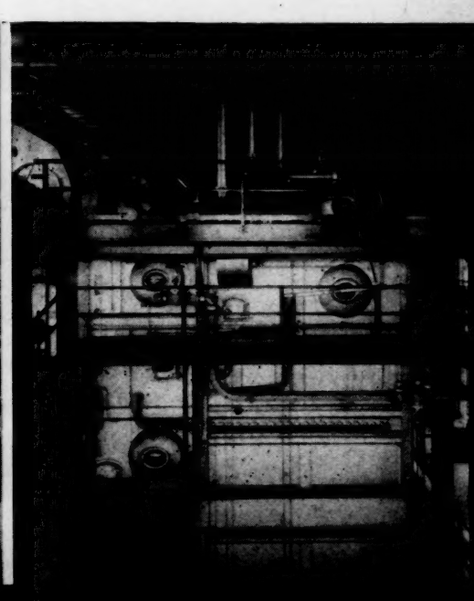
Soot cleaning equipment consists of two sets of five elements each for the large boilers, and one set of five for the small boilers. Two sets are required on the large boilers for the furnace is approximately 22 ft. wide. The blowers are of the rotary valve-in-head type, chain operated from the main floor.

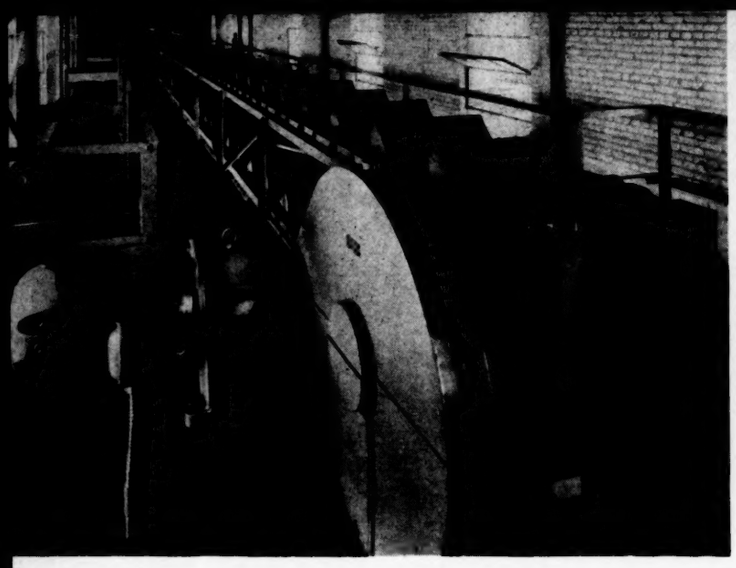
The automatic combustion control referred to earlier is of the electric type. It includes on the main panel board, a main control and remote hand control. The control regulates the boiler dampers by motor control, louvers on the forced draft fans, and stoker feed as well as the feed of coal to the stokers. So accurately does this system work, the fires on test and try-out were instantly dropped from 300% rating to less than 25% without popping a single safety valve.

The steam piping 2 in. and larger is of welded construction, and the valves are cast steel, 300 lb. working pressure. Motor-operated valves for such equipment as the steam jet ash ejection system have remote-control push button switches for operation at the rear of the boilers.

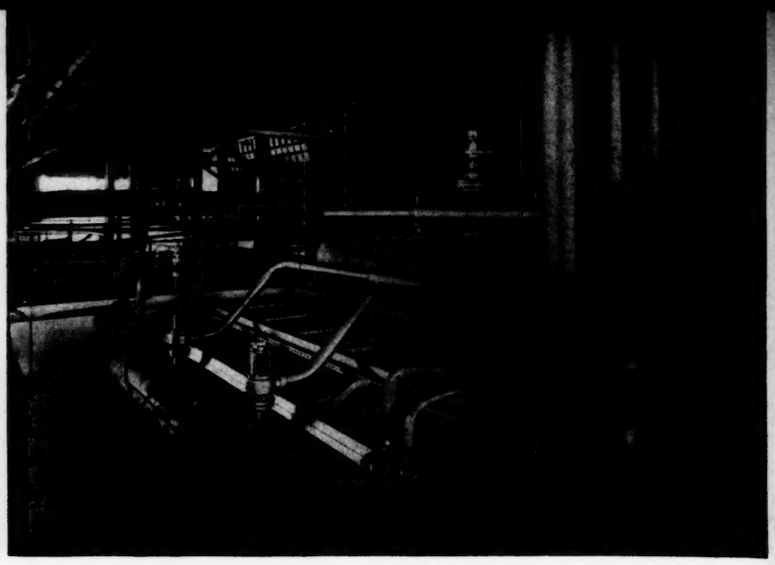
At the left (below) are four Sturtevant fans for supplying combustion air. The two far units supply 40,000 c.f.m.; the two small units, 20,000 c.f.m. The coal bunker is shown in the upper center. It is of Allen-Sherman-Hoff design and suspended from girders by means of iron bands freely hanging as a ca tenary. Also shown is the coal larry. (Middle) The coal larry is seen in position to discharge fuel to the stoker hopper. (Right) Side of one of the Erie City Iron Works boilers.







Coal is carried from the track hopper to the coal bunker by an elevator and Link-Belt apron conveyor.



A close-up of the steam drum of one of the generators with the coal bunker shown in the center and right background.

McCHORD STEAM DISTRIBUTION AND HEATING

By J. W. A. DRUMMOND*

STEAM required for heating and utility purposes in the various buildings at McChord Field is distributed through two different systems—a high pressure system at 150 lb. per sq. in. and a low pressure system at 5 lb. per sq. in. The high pressure system serves those buildings requiring high temperature steam while the low pressure system serves buildings requiring steam for building heating only. The structures served by high pressure steam include barracks, hospital, four hangars, photographic laboratory building, paint and dope building, and fire and guard house. The low pressure system serves the gas station, A.C. warehouse, Q.M. maintenance building, Q.M. warehouse and No. 3 warehouse.

Distribution Trenches

All steam and return pipes are contained in reinforced concrete trenches which vary in width and depth according to the size and number of pipes accommodated. The top of the trench sides are rabeted to hold the trench covers in place. These trench covers are reinforced concrete slabs with two handles or lifting rings, one at each end to facilitate the placing in position or removal. Placing covers and sealing the trench after completion of the piping work was accomplished in the following manner. First a strip of ¼ x 3 in. bitumastic felt was laid on the lower side of the rabet, then hot bitumastic poured along the top of the trench walls, then two cover plates without projecting lips placed in position on the side walls leaving a space for the cover plate which is equipped with lips to overlap on the first pair of covers. Next, the supporting lips on the covers were given a heavy coat of bitumastic cement and the cover laid in place between them. Bitumastic cement was poured over the joint to prevent any surface water from leaking in between the joints and the covers.

The concrete trenches slope toward the manholes which have sumps to gather any water which may accumulate. These sumps have gravel bottoms and being above the subsoil water level any water drains away quickly.

The manholes vary considerably in size and depth according to the size and amount of equipment they accommodate. The smallest is 6 ft. x 5 ft. 6 in. x 4 ft. while the largest is 9 ft. x 8 ft. 6 in. x 11 ft. 6 in. They are all of reinforced concrete having an 8-in. slab floor with a 24-in. square sump and 10-in. end walls. The ceiling slabs vary in thickness from 4 to 5 in. depending upon the location of the manholes. A short reinforced concrete shaft supports the manhole cover and frame. There are 27 manholes, four anchor boxes, and about 5600 ft. of trench and 2300 concrete trench covers in this system.

High Pressure System

A 12-in. high pressure steam main from the central heating plant carries steam to the first manhole A, located approximately 15 ft. from the pump pit in the central heating plant. The trench which carries this 12-in. main also contains a 6-in. return main and a 2-in. high pressure drip return. In this first manhole the steam main is divided into two branches—one 8-in. line serving the hangar section of the Field and one 6-in. line serving the barracks and hospital.

The 8-in. line has a single expansion joint with anchor, 8-in. traverse and an 8-in. gate valve in the manhole. From the manhole the 8-in. main runs to the F Street bridge tunnel where the pipe is anchored before crossing the bridge. Another expansion joint with anchor is placed in the bridge tunnel from which the pipe runs 225 ft. to the next manhole J. The 6-in. return line has a single expansion joint in manhole A and in the bridge tunnel. There are also valves on the return line and in the 1-in. high pressure drip in manhole A.

In manhole J, a 3½-in. branch steam line is taken

*Mechanical Inspector, Constructing Quartermaster's Office, McChord Field, Washington.

off to serve hangar 1. Also in this manhole are two single expansion joints with anchors to take up the expansion in the 8-in. main and two 6-in. expansion joints to take up the expansion in the return main. The 3½-in. branch steam line to hangar 1 is also equipped with an expansion joint. A 4-in. branch steam and a 3-in. branch return as well as a 1-in. high pressure drip are valved and blanked in this manhole for future connections.

The next manhole on this line, N, approximately 200 ft. from J, contains expansion joints for the 8-in. line, the 5-in. return main, a 3½-in. branch steam supply and return to the pump room between hangars 1 and 2, and a 1-in. steam and return line to the paint and dope building. A U-bend is provided on this latter line to take up the expansion.

From N the 8-in. steam supply line runs to manhole P which contains two 8-in. expansion joints, return line expansion joint, as well as expansion joints for a 3½-in. branch and return which leads to hangar No. 2 and U-bends for a 1½-in. steam and return line which leads to the photographic laboratory building about 140 ft. away.

Manhole O, the next manhole on the 8-in. main, has besides the usual expansion joints, 3½-in. branch connections which supply hangar No. 3.

Manhole R has the usual expansion joints and a 3½-in. connection to supply hangars 3 and 4. In this manhole the 8-in. steam main is reduced to 6 in.

In manhole S there is, besides the expansion joints, a 3½-in. branch steam main which serves hangar 4 while in manhole T there is a 3½-in. branch, valved and blanked off for future connections, as well as expansion joints.

Manhole U is the end of this line and the 6-in. supply and 5-in. return mains are blanked off here. A 1½-in. steam and return line is taken off the mains here to serve the fire and guard house which is about 150 ft. away.

Barracks and Hospital Supply

The 6-in. high pressure main in manhole A provides steam for the barracks and hospital. This line has seven manholes designated as A to H. The pipes in the section between manholes A and C are a 6-in. supply, 4-in. return, 2-in. vacuum and 1½-in. high pressure drip. At C a 5-in. steam branch and a 4-in. return are valved and blanked off for future connections.

At D two future branches are provided for by valved and blanked off mains. At E a 4-in. steam line and a 3-in. return branch off to supply one of the three pump rooms in the barracks.

After leaving manhole E the steam and return mains are reduced in size to 4 and 3 in. respectively. These lines run to F where they are divided into two branches, one group going to G and the other to H. The branch which goes to H has a 3½-in. main and a 2½-in. return to serve the other end of the barracks. The other branch which goes to G has a 4-in. supply and a 3-in. vacuum and a 1½-in. high pressure drip and has its ends blanked off and valved. A 2-in. steam, 2-in. vacuum and 1¼-in. high pressure drip, all of which are valved, supply the hospital.

Expansion joints are provided in all of the manholes on the larger mains while expansion bends are used on the smaller pipes. All main steam lines are provided with drips and traps at all manholes.

Low Pressure Distribution

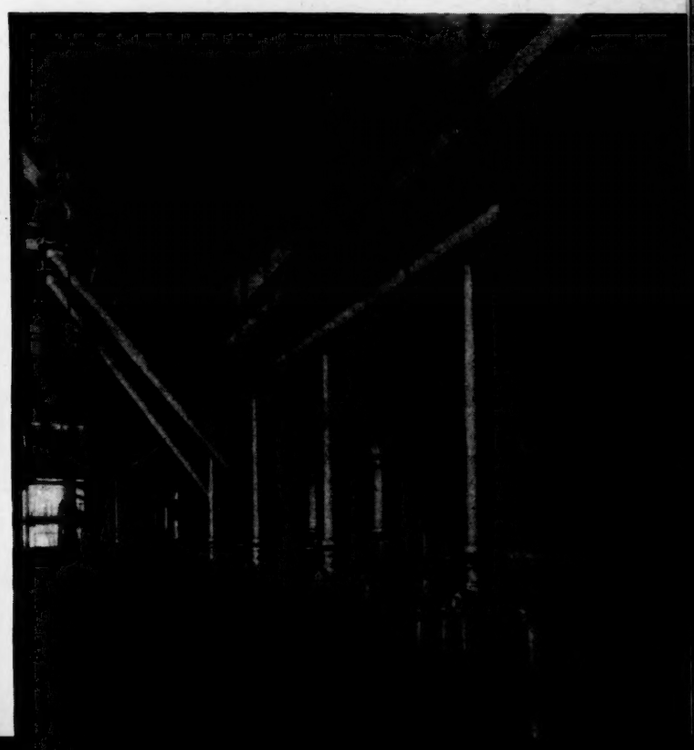
The low pressure system starts in manhole 1, 10 ft. from the pump room in the central heating plant, the short connecting trench 10 ft. long containing an 8-in. steam main and 4-in. vacuum line.

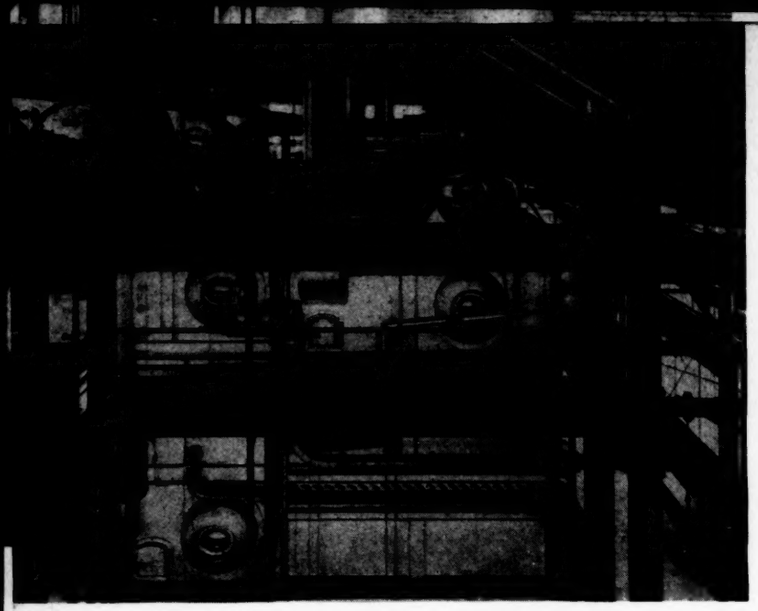
In manhole 1 are two expansion joints with anchors, one on 8-in. steam and the other on 4-in. vacuum line, 4-in. lift fitting on vacuum line. From manhole 1 to manhole 2 the lines are carried in a trench 225 ft. long.

Manhole 2 has 3-in. steam and 1½-in. vacuum lines,

Shows a side elevation of the Hoppes deaerating feed water heater with its interconnecting piping. In the lower background are the feed pumps.

At the rear of each furnace is the arrangement for handling fly ash which is either sent to the ash removal system or reinjected into the furnace and burned.





Top of the boiler showing the Prat-Daniel induced draft fans and Thermix recirculator dust collecting system.

valved and blanked off for future connection, an 18 in. x 16 in. bricked-up opening in manhole wall also being provided. A single expansion joint on steam main and a single expansion joint on vacuum line take care of the expansion to manhole 3, 200 ft. distant.

Manhole 3 has an anchorage for both mains and a 3-in. steam and 1½-in. vacuum valves and blanked off for future connection. A 2-in. steam and 1-in. vacuum line are valved and lead to the gas station about 75 ft. distant. From manhole 3 the steam line is reduced in size to 6 in. and the vacuum line to 3½ in. and run in a trench 250 ft. long to manhole 4.

Manhole 4 has single expansion joint in main steam and single expansion joint in vacuum return, both of which are anchored; 2½-in. vacuum line has lift fitting. A 5-in. valve branch steam and 2½-in. valve branch vacuum line leads from left of main through a trench 120 ft. long to manhole 8.

Manhole 8 has 3-in. steam and 2-in. vacuum lines valved and blanked off for future connection and a single anchored expansion joint on steam line and single anchored expansion joint on vacuum line. From manhole 8 to manhole 9, pipes are carried in a trench 130 ft. long.

Manhole 9 has a single expansion joint on steam line and single expansion joint on vacuum line, both of which are anchored. These two mains lead from this manhole through a trench to an anchor box 50 ft. away and then lead into the A.C: warehouse.

On the right hand side of manhole 4, a valved 3-in. steam and 1½-in. vacuum line, both provided with single expansion joints, lead through a trench to the Q.M. maintenance building 100 ft. distant. These mains lead into an anchor box and then into the valve pit where connections are made to the building mains. From manhole 4 the main steam and vacuum lines run 100 ft. to manhole 5.

Manhole 5 has a single anchored expansion joint on steam main, a single anchored expansion joint on steam line and two single expansion joints on vacuum main. A 3-in. branch steam and 2-in. branch vacuum line, both of which are valved, lead into the Q.M. warehouse. From manhole 5 the steam line to manhole 6, 180 ft. away, is reduced to 5 in.

Manhole 6 has one anchored expansion joint on steam main and one anchored expansion joint on vacuum main. Steam lines are valved and lead in a trench to an anchor box 100 ft. distant, where they terminate at an anchor box and are blanked off for future connection to No. 3 warehouse. A 4-in. steam and 2-in. vacuum trench lines are valved in this manhole and lead off from left of the mains to manhole 7, 180 ft. distant.

Manhole 7 has single expansion joint with anchor on steam main and single expansion joint with anchor on vacuum line and blanked off with 3½-in. and 2-in. valved connections for future services. All steam mains have drip connections and traps in all manholes.

Building Heating Systems

The barrack building houses a consolidated mess 80 ft. wide and 220 ft. long with enough capacity to feed the entire command at one sitting. This mess requires 40 lb. of steam for heating hot water, cooking, diswashing, and other uses. The steam is reduced from 150 lb. to 40 lb. per sq. in. and the 40-lb. branches are run to hot water tanks. Another 40-lb. branch runs to a pump room beneath the kitchen to heat the water and to supply the kitchen with steam for cooking. The 40-lb. steam is further reduced to 5 lb. for use in radiators and unit heaters. There are approximately 18,700 sq. ft. of radiator surface in the building and 36 unit heaters with a capacity of 1,800,000 B.t.u. per hour, making a total load of approximately 300 hp. at full capacity for heating, cooking and hot water.

The hospital also is supplied with steam at 150 lb. per sq. in. which is reduced to 40 lb. for hot water heating, cooking, sterilizing and surgical purposes. It then is further reduced to 5 lb. to supply heat to the 1850 sq. ft. of radiator surface. The returns are passed to a vacuum line which is connected to a vacuum pump in one of the barrack pump rooms. The high pressure drips go to a condensate pump in the same pump room. Total steam load of this building is about 25 hp.

The hangars are supplied with 150 lb. steam which is reduced to 40 lb. pressure in the pump pits, of which there are six. The two main pump pits are between each pair of hangars and are equipped with a flash tank and condensate pump to return the condensate to the central heating plant. Returns and all high pressure drips discharge into the flash tanks and from there into the pumps. No returns are handled in any other pump pits which are used for steam supply purposes only. The offices and hangars 1, 2 and 3 are heated with an air conditioning system while the workrooms along the rear of the hangars are heated by unit heaters under thermostatic control. The main body of the four hangars is heated by four large unit heaters each having a capacity of 1,125,000 B.t.u. per hour.

These unit heaters are located at approximately 22 ft. above the floor and each discharges approximately 25,000 cu. ft. of air per min. in a downward direction. In hangar 4 the offices are heated with unit heaters while the observation tower is steam heated by two convectors. The four hangar door sills are heated by 2½-in. extra heavy steam pipes running the full length

of the door openings and returning to the point of connection back to the return main. Steam is supplied to these pipes at 40-lb. pressure through chain operated valves. The approximate heating load in each of the four hangars is approximately 24,000,000 B.t.u. per hour, making a total of about 850 hp. for the four hangars.

The photographic laboratory is heated by approximately 600 sq. ft. of radiator surface in the workrooms and a complete summer and winter air conditioning system in the processing rooms. These rooms have both unit heaters and unit coolers operated automatically under thermostatic controls. Total load including hot water heating is about 12 hp.

The paint and dope building is heated with one 42,000 B.t.u. unit heater.

The fire and guard house has two unit heaters of 215,000 B.t.u. capacity and approximately 1260 sq. ft. of radiator surface all operating under 5 lb. pressure and a hot water generator heated by 40 lb. steam. Total load is about 22 hp.

The gas station is heated with one small unit heater.

The air conditioning warehouse has six unit heaters of 600,000 B.t.u. capacity and approximately 361 sq. ft. of radiator surface, the total load being approximately 22 hp.

The Q.M. warehouse has nine unit heaters of 715,000 B.t.u. capacity, the total load being approximately 23 hp., while the Q.M. maintenance building has six unit heaters of 310,000 B.t.u. capacity and approximately 200 sq. ft. of radiator surface as well as one hot water generator with a total load of about 16 hp.

Contractors

Contractor	Buildings
Walter S. Leland Co., San Francisco, Cal.	Central Heating Plant
Lord & Loryea, Portland, Ore.	Steam Distribution Hangars Barracks
Advance Plumbing & Heating, Tacoma, Wash.	Fire and Guard House Photo Laboratory Hospital Q. M. Maintenance
Gehri Plumbing & Heating, Tacoma, Wash.	A. C. Warehouse
United States Government	Paint and Dope Bldg. A. C. Gas Station

Equipment

Control Heating Plant

Boilers—Erie City Iron Works.
Coal bunker—Allen-Sherman-Hoff.
Stokers—Hoffman Combustion Engineering Corp.
Forced draft fans—B. F. Sturtevant Co.
Exhaust fan—Prat-Daniel induced draft fan.
Dust collecting system—Thermix.
Reinjection of fly ash to furnace—Clarage fans.
Ash steam jet—Allen-Sherman-Hoff.
Boiler feed pumps—Economy Pumps, Inc.
Pump governors—Mason Neilan Regulator Co.
Water feed controller—Copes-Northern Equipment Co.
Vacuum pumps—Chicago Pump Co.
Water conditioner—The Permutit Co.
Deaerating heater—Hoppes Mfg. Co.
Soot cleaners—Vulcan.
Automatic combustion control—The Hays Corp.
Motor operated valves—Minneapolis-Honeywell Regulator Co.

Steam Distribution System

Float and thermostatic traps—The Trane Co.
Inverted bucket traps—The Trane Co.
Strainers—The Trane Co.
Pipe supports—Crawford Co.

Side view of one of the steam generators with the control panel at the right. In the corner, left background, is shown the Permutit automatic water conditioners.

Expansion joints—American District Steam Co.
Welding fittings—Walworth Co.
Valves—Powell Co.
Pipe steel—Bethlehem Steel Co.
Pipe, wrought iron—A. M. Byers Co.
Steel channel for supports—Bethlehem Steel Co.
Reinforcing steel—Bethlehem Steel Co.
Pipe covering—The Philip Carey Co.

Barracks

Vacuum and condensate pumps—Nash Engineering Co.
Unit heater and torridors—The Trane Co.
Traps, strainers, radiator valves—The Trane Co.
Reducing valves—Kieley & Mueller, Inc.
Valves and fittings—Walworth Co.
Pipe—Wheeling Steel Corp.
Thermostats—Minneapolis-Honeywell Regulator Co.
Hangers and inserts—Grinell Co.
Pressure gauges—Jas. P. Marsh Corp.
Expansion joints—American District Steam Co.
Pipe covering—Johns-Manville.

Hospital

Radiators—American Radiator Co.
Valves and fittings—Walworth Co.
Reducing valves—Davis Regulator Co.
Traps, radiator valves and strainers—The Trane Co.
Pipe covering—Johns-Manville.

Hangars

Unit heaters—C. A. Dunham Co.
Controls—Minneapolis-Honeywell Regulator Co.
Valves and fittings—Walworth Co.
Reducing valves—Kieley & Mueller Inc.
Traps and Strainers—C. A. Dunham Co.
Hangers—Grinnell Co.
Pipe—Bethlehem Steel Co.
Condensate pumps—Dayton-Dowd Co.
Expansion joints—American District Steam Co.
Pipe covering—Johns-Manville.

Paint and Dope Building

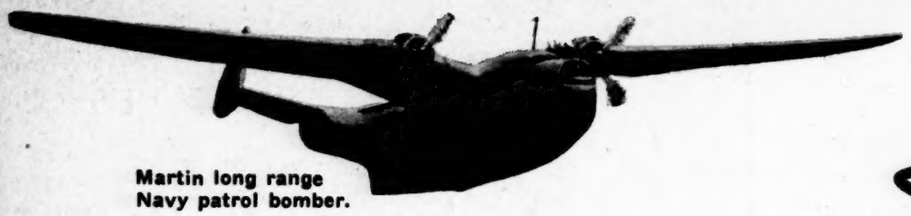
Unit heaters—Ilg Electric Ventilating Co.
Explosion proof thermostats—Cutler-Hammer, Inc.
Traps and strainers—The Trane Co.
Valves and fittings—Walworth Co.
Hangers and inserts—Crawford Co.
Pipe covering—Johns-Manville.
Reducing valve—Fisher.

Fire and Guard House

Unit heaters—Modine Mfg. Co.
Radiators—U. S. Radiator Corp.
Controls—Minneapolis-Honeywell Regulator Co.
Valves and fittings—Walworth Co.
Reducing valves—McAlear Mfg. Co.
Traps, strainers and radiator valves—Jas. P. Marsh Corp.
Pressure gauges—Jas. P. Marsh Corp.
Pipe covering—Johns-Manville.
Condensate pump—American-Marsh Pumps, Inc.

Photographic Laboratory Building

Valves and fittings—Walworth Co.
Controls—Minneapolis-Honeywell Regulator Co.
Reducing valves—McAlear Mfg. Co.
Traps, strainers and radiator valves—Jas. P. Marsh Corp.
Pipe covering—Johns-Manville.
Condensate pump—American-Marsh Pumps, Inc.
Pressure gauges—Jas. P. Marsh Corp.



Martin long range Navy patrol bomber.

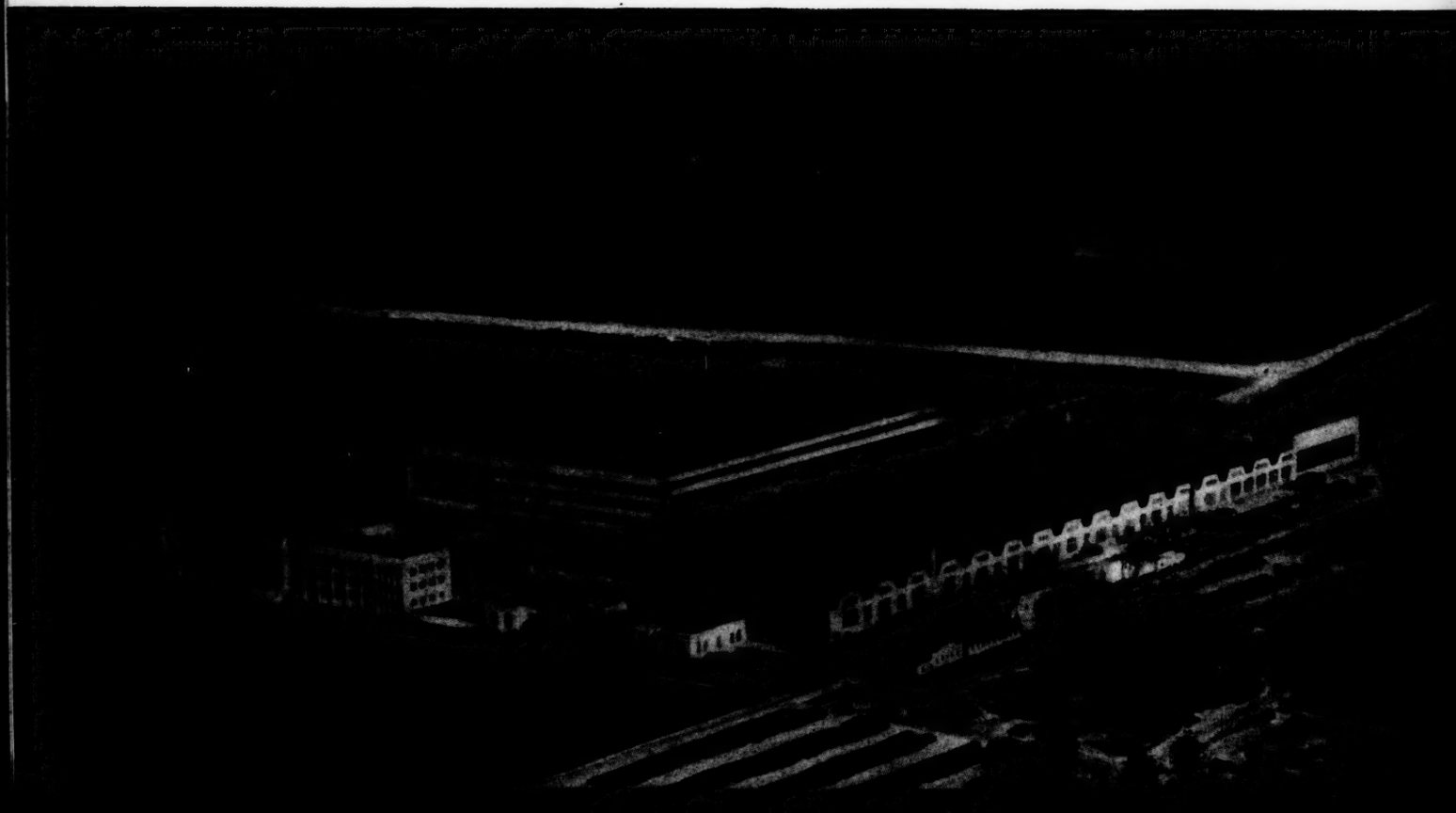
The GLENN

The new building C of the Glenn L. Martin Company's plant at Middle River, Maryland, was designed jointly by the engineers of the Glenn L. Martin Company and the architects of Albert Kahn Associated Architects and Engineers, Inc., Detroit. Heating contractor was the Lee Engineering Co., Youngstown, Ohio, while the air conditioning equipment was installed by Paul L. Vincent Company of Baltimore, Md.

AN indication of the rate at which American aviation industry can expand its production facilities is furnished by the new addition to the plant of the Glenn L. Martin Company of Middle River, Maryland. On a Friday in the early part of February, 1939, the Glenn L. Martin Company received an order for a large number of bombing planes. This order necessitated an increase in production facilities so it was decided to erect a $1,850,000 addition to the plant. On the following morning steam shovels were at work and in just seventy-seven days the new addition was taking the initial steps in turning out planes.

What an achievement this was can be seen when it is realized that the building is a two-story structure of concrete, steel and glass, 694 ft. long by 342 ft. wide with a basement headroom of 14 ft. and a first floor ceiling ranging in height from 18 to 28 ft. The floor area of this addition is approximately 440,000 ft.

The addition which is known as Building C is just a part of the large plant of the Martin Company. The company owns a tract of approximately 1200 acres at Middle River, near Baltimore, Maryland. At the present time there is erected on the area an administration building, an engineering building, and three manufacturing buildings known as buildings A, B, and C. The floor area occupied by the factory and office space is



Air view of the Glenn L. Martin Company's air craft plant at Middle River, Md. In the background can be seen part of the 600 acre airport, said to be the largest privately owned air field in the country.

AIR CONDITIONING FOR AIR DEFENSE

L. MARTIN COMPANY

HEATS ITS NEW 440,000 SQUARE FOOT ADDITION WITH FIVE SEPARATE FORCED WARM AIR SYSTEMS

approximately 1,100,000 sq. ft. and there are more than 12,000 employees now employed in this plant. Also located on the tract is a 600-acre airport, said to be the largest privately owned air field in the United States.

Because of the large size of Building C and because of the large doors, the heating system should be of considerable interest to engineers. As stated before, this building is of two stories, the upper level being used for assembly of planes while the lower level is employed for sub-assembly feeding to the big assembly line upstairs. Here also is the project loft, where full-scale drawings are made on coated metal sheets and photographed directly onto similar sheets in a process developed by the Martin Company. These photographic reproductions are used throughout the designing and tooling and manufacturing processes.

Due to a decision to heat the building without a boiler plant and because of the character and location of the building, a forced warm air heating system is used. Simply described, the heating is done by five separate forced warm air systems, with the supply air distributed by ducts at the ceiling of the basement to ceiling outlets in the basement and floor outlets on the first floor. Air is returned to the heating units through grilles in the first floor and through openings in the heater room walls.

Heater Rooms

As shown in floor plan, three heater rooms are located near the center of the basement while two are near the southwest side of the plant. Essentially these heater rooms consist of a large oil fired heater and a forced air and induced draft fan both driven by the same motor. Air enters the heater room through grilles in the walls, passes through the room where it recovers any heat lost by radiation from the heater, goes to the forced draft fan and is then forced through the heater and the supply ductwork. The heater consists essentially of a combustion chamber, a heating element, and an exterior brick casing. The heating element consists of banks of black steel tubes bent to U shape with the ends cemented into cast iron headers. The entire tube element is enclosed in a heavy fire brick setting with the tubes separated from the combustion chamber by a thick bridge wall and are protected from direct exposure to the flames by a layer of fire clay baffle tile.

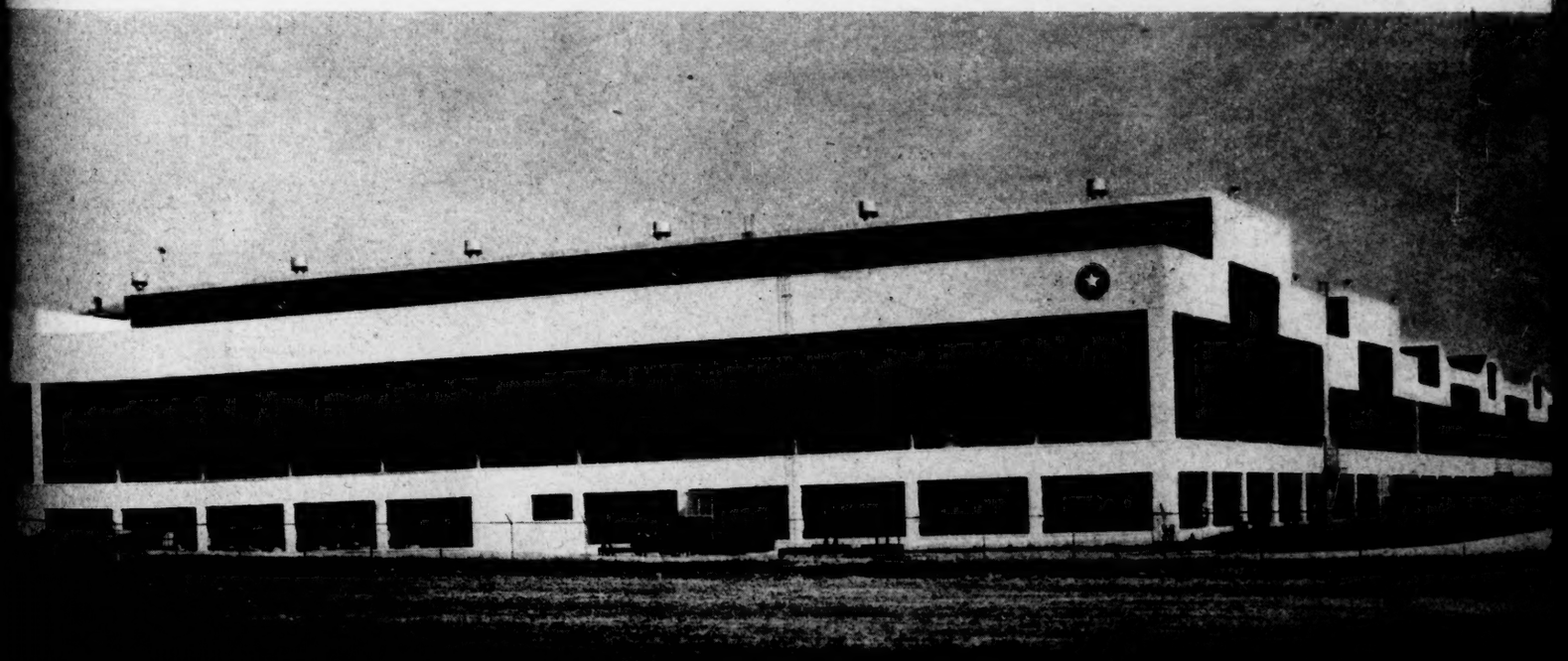
The hot gases originated in the combustion chamber pass over the bridge wall, travel the full length of the heater, and then return through the tube chamber, finally being exhausted by an induced draft fan.

These heater rooms are quite large and there is plenty of room for the maintenance personnel to enter, inspect, and make any adjustments necessary to the oil burner, air heater, or fan.

The heated air leaves the heater room through overhead ducts and in the case of the basement supply, is distributed through ceiling outlets located a few feet from the outer walls. These outlets discharge the air toward the outer walls, thus tending to overcome the effect of the cold walls and to prevent drafts.

The greater part of the heated air is distributed to the first floor by both floor and column outlets. The floor outlets are of the flush type with fixed vanes, and are located near the outer walls of the building. The

Building C which was erected in 77 days.



vanes are directed so as to supply heated air to regions of high exposure and to those places where infiltration may occur. The center portion of the factory floor is heated with column outlets located at the foot of the steel structural columns. This not only conserves space but also serves to protect the outlets from damage.

The discharge of large quantities of warm air at the floor level on the first floor has made it possible for this plant to maintain a uniform and comfortable temperature in the occupied zone. To further prevent drafts floor registers, located between the flush type supply outlets near the walls, serve to return the air from the first floor to the basement. These registers are not connected to ducts as the whole basement is used as a return. Open stairwells between the first floor and basement also serve as returns.

In the basement is located a large employees cafeteria seating 350 employees which is completely air conditioned. The conditioning system for the cafeteria is located in a fan room about 50 ft. from the cafeteria. Outside air is brought in from an outside air intake on the roof through a duct running next to an elevator shaft to the fan room. Here it is mixed with the recirculated air and enters the air conditioning unit. This unit consists of oil type filters, air washer, and cooling coils. A centrifugal fan then forces the air through a fresh air supply trench located in the basement floor at the side of the fan room. This supply trench carries conditioned air to the air distributing ducts in the cafeteria and kitchen. An exhaust and recirculating duct at the side of the cafeteria carries the exhaust air to a fan located in the fan room and part of this air is recirculated back to the air conditioning unit and part goes to the exhaust duct which carries it to the roof. A separate exhaust system is provided for the kitchen and dish-washing room. The exhaust air from these rooms is carried by a separate duct to a kitchen exhaust fan in the fan room and is then discharged through a separate exhaust duct to the roof. Cooling is done by direct expansion of Freon which is supplied by a 50-ton compressor located in the fan room and an evaporative condenser located on the roof of the building.

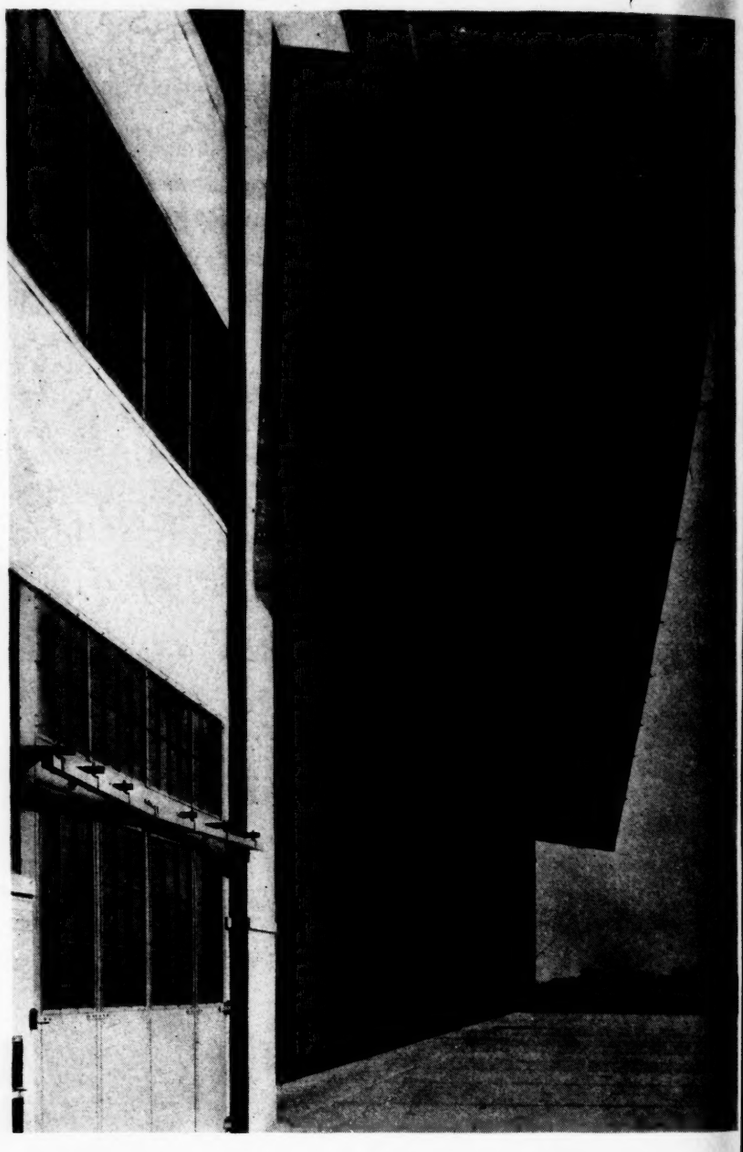
In the 40 ft. section between Building C and Building B, is a first aid room, recovery room, and superintendent's office. These three rooms are cooled with a separate 10-ton air conditioning system. This system uses direct expanded Freon and has an electric heating coil for supplementary heating during the winter.

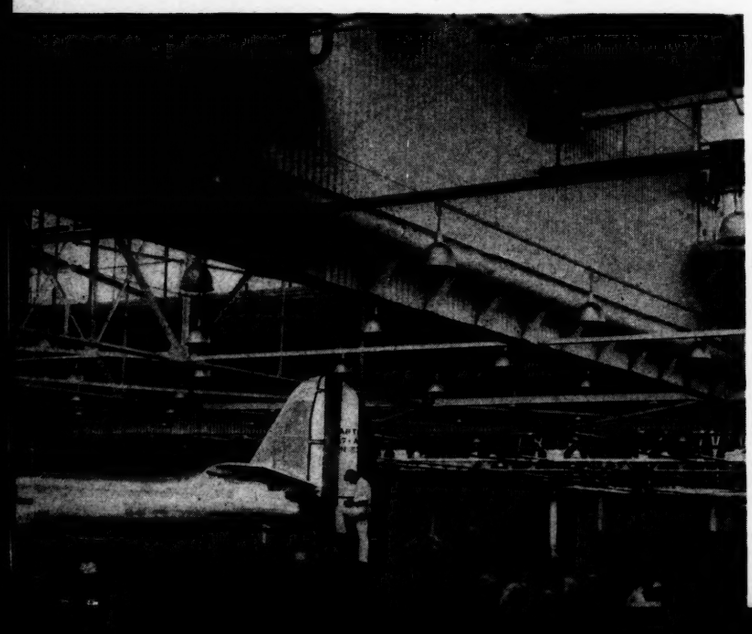
Although the other sections of the plant were built

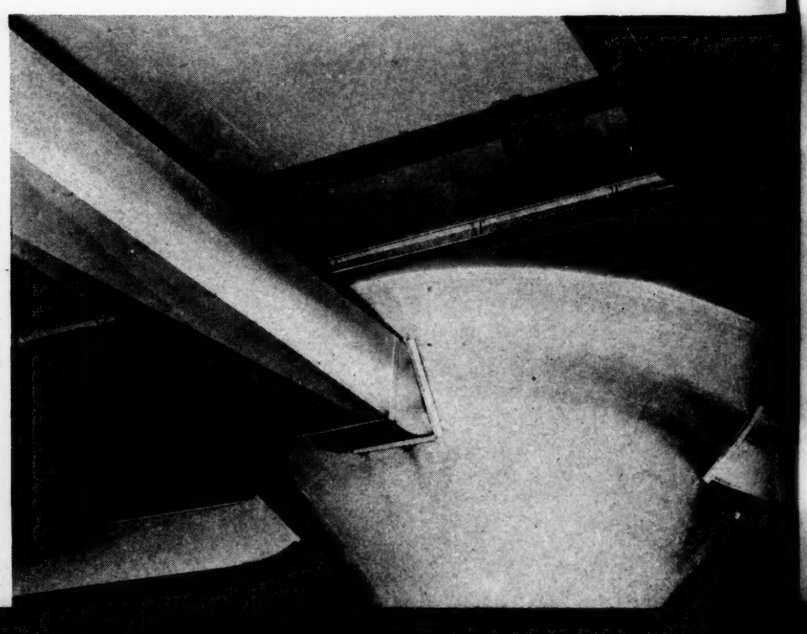
Paint spray area in Building C. High velocity air discharged vertically downward from the jets forms a curtain around the paint spray area to prevent fumes from spreading throughout building. American Blower exhaust fans in roof over paint spray area withdraw fumes. (Lower left)

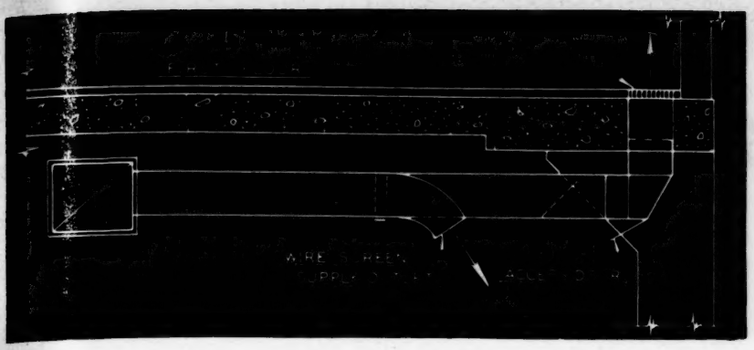
Basement column showing how column outlet on first floor is supplied with air from basement ducts. (Lower right)

This single door, 45 ft. high and 303 ft. long, makes heating this building a difficult problem. However, by supplying heated air through a continuous slot at door and through floor and column outlets the building is kept at comfortable temperatures even in severe weather. (Below)









Cross section of first floor showing air supply ducts. Note air supply grille in floor near outer wall and supply outlet at ceiling of basement.

during the period from 1929 to 1939, there is much interest in them and brief description is included here.

Building A

Building A was built in 1929 and is approximately 900 ft. long by 300 ft. wide. It is heated by oil fired warm air heaters of a brick enclosed type used in Building C. Heated air from the heating units is supplied to mushroom outlets located at the floor level. Return air is taken from the building at locations near the outer wall.

In the basement of this building is a boiler room equipped with two boilers which generate steam at 90 lb. pressure. This steam is employed for heating the administration building, for process use, and for heating certain office and cafeteria areas in the plant. Because of the necessity of low chimneys, induced draft fans are used to exhaust flue gases from the boilers through low stacks. In the basement of Building A is also housed all equipment such as compressors, oil pumps, electric frequency chargers, and maintenance shops.

The fuel oil distribution system is of considerable interest because it is a central type system, that is, all of the fuel oil used in the plant is stored in central oil storage tanks holding 15,000 gallons of Bunker C oil and is pumped to all of the oil burners throughout the plant. In order to facilitate the pumping, the oil in the storage tank is kept at a temperature of about 120F by steam coils. From the tanks, the oil flows to the pump room which contains three circulating pumps and two oil heaters, as well as separate pumps which are used for forcing the oil from the railroad cars to the outside storage tanks. Because of the distance through which the oil must be pumped—as much as 1400 ft. in some cases—the two heaters in the pump room heat the oil to 207F. To further facilitate the pumping, all of the oil supply and return pipes are run through the pipe tunnels and are placed next to the steam supply main. Insulation encloses the three lines so that the heat from the steam main is employed to keep the oil warm.

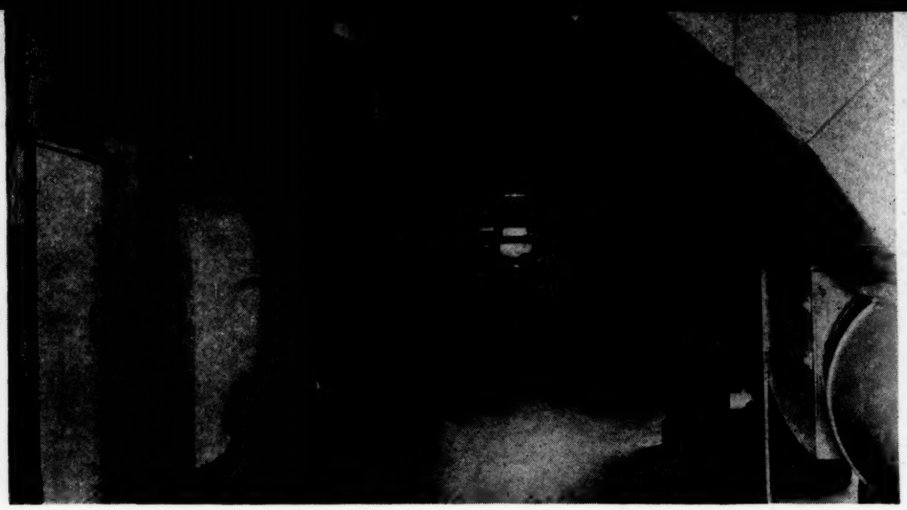
Building B

Building B was erected in 1937 and is approximately 453 ft. long by 303 ft. wide, not including the 40 ft. section between Buildings A and B. It has an unobstructed headroom clearance of 45 ft. and is said to be the largest unobstructed airplane space anywhere in the world. This building is also outstanding in that it has a single door, the height of a three-story building, and the length of a city block. This door is approximately 45 ft. high and 303 ft. long. Four heaters are employed in this building and supply air to inlets at the floor levels near the walls, and to a continuous supply slot placed at the door to reduce drafts. Return air is brought back through floor grilles to heating tunnels and then to the heaters. The heater room in this building is located directly beneath the center of the building floor and contains the four heating units. In the 40 ft. section between this building and Building A, there is located an air conditioned first aid and superintendent's office, as well as an air conditioned cafeteria.

Engineering Building

The engineering building was erected in 1937 and is air conditioned throughout. Two heater rooms are provided, each containing an oil-fired air heater with metal casing. One heater room takes care of the east end of the building while the other supplies the west end.

One of the heater rooms. At the left is a Lee direct air heater fired by two Todd oil burners burning bunker C oil. All oil is pumped from central 15,000 gal. storage tanks by two Blackmer oil pumps. At right can be seen American Blower forced draft fan and air supply fan driven by a single G.E. motor.



Air conditioning system for basement cafeteria in building C. A 50-ton Frick compressor supplies high pressure freon to American Blower evaporative condenser located on roof. All air is cleaned by an oil type American air filter.

Also located in these rooms are the air conditioning equipment.

Cooling is furnished by a tandem Freon compressor consisting of one electric motor and two 125-ton compressors. Direct expansion cooling coils are located in the conditioning units and an evaporative condenser is located on the roof. A more complete description of these two buildings is contained in HEATING & VENTILATING's December 1938 issue, pages 15 to 17.

Administration Building

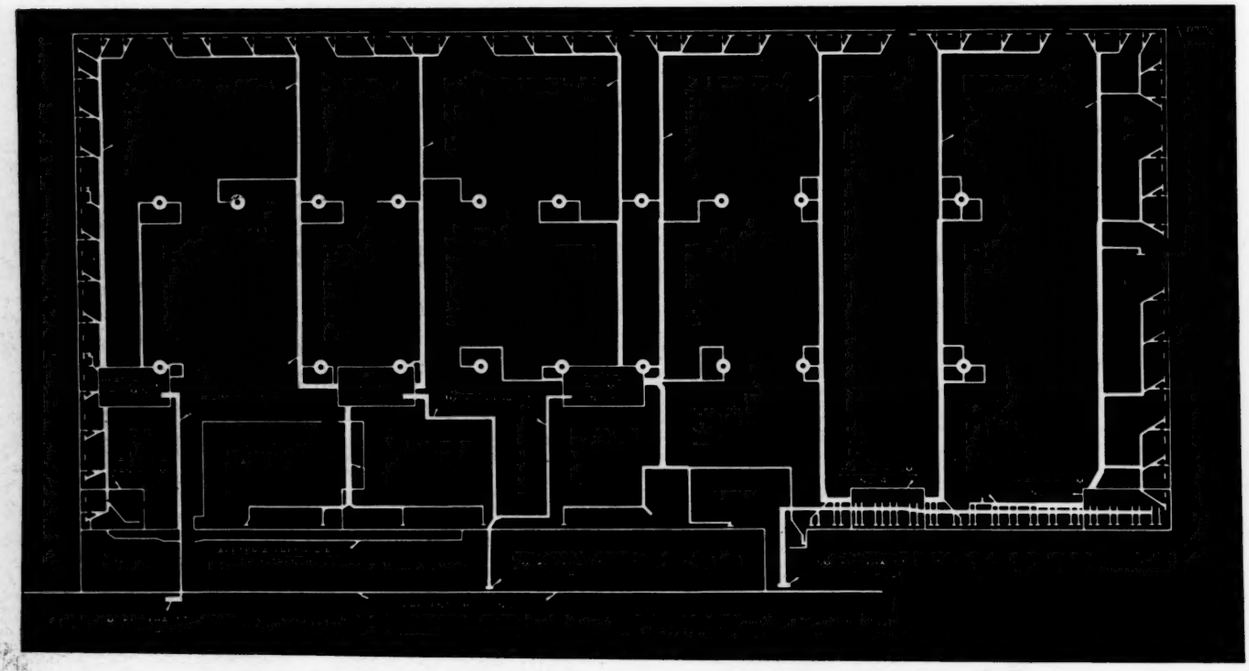
The Administration Building was erected in 1930 but was not air conditioned until 1937. This is the only building in the plant which is heated by steam. When the conditioning system was installed, the original steam heating system was left in place and is now employed for supplying part of the heat needed for winter conditioning. Steam is brought to the building from the main boiler room located in Building A at a pressure approximately 90 lb. per sq. in.

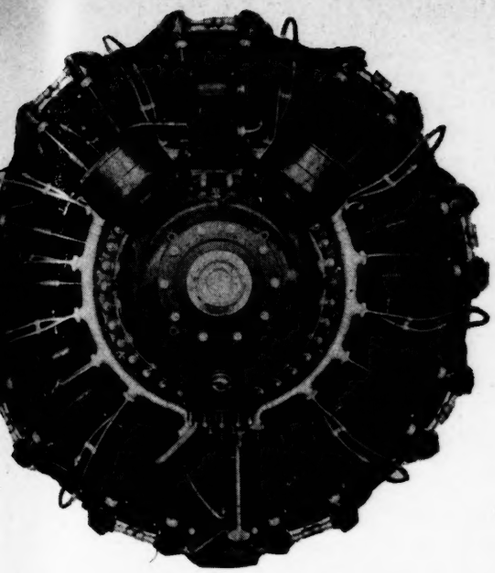
Summer cooling is provided by two Freon compressors one with the capacity of 30, and the other with the capacity of 20 tons, and direct expansion is employed.

An evaporative condenser is located in the basement as the roof was not strong enough to support this equipment. The condenser draws air from the basement and discharges it through ducts to the outside.

Administration Building with a section of Engineering Building shown at left. Both buildings are completely air conditioned with American Blower conditioning systems and Frick compressors. Administration Building is heated with a steam system supplied with steam by Babcock & Wilcox boilers while the Engineering Building is heated with Lee heaters.

Plan of Building C basement showing location of heater rooms and arrangement of air supply ducts. First floor is heated with floor outlets at walls and column outlets indicated by small circles. Basement is heated with supply outlets located at ceiling near outer walls. Minneapolis-Honeywell controls are used.





AIR CONDITIONING FOR AIR DEFENSE

PRATT & WHITNEY *Aircraft*

Division of United Aircraft Corp., Heats Its New Addition with Unit Heaters Using Exhaust Steam from Engines Driving Compressors.

ONE of the world's leading producers of airplane engines is Pratt & Whitney Aircraft, a division of the United Aircraft Corporation located at East Hartford, Connecticut. Although this company is only 15 years old, it ranks high on the list of large makers of airplane engines and its product is world famous because of the spectacular flights of such famous aviators as Wiley Post, Amelia Earhart, Dick Merrill and scores of others and because of the increasing use of its engines by the Army and Navy, and leading air lines.

So great has been the demand for the engines of this company that its plant area has grown from a few hundred feet in 1925 to over a million square feet. Although a large addition was made to the plant in the latter part of 1939, it was not enough to meet the demands for manufacturing space and now another extensive addition is under way.

The first engine developed by the company, a single-row radial air cooled model which developed 400 hp., was called the Wasp. Later, the Hornet model was developed and in 1929 the company produced the first successful 14-cylinder twin-row radial engines in the United States. Since then these engines have been setting new standards in the high horsepower field. During the past year, with the cooperation of Army and Navy engineers, Pratt & Whitney Aircraft has developed a new 18-cylinder twin-row engine, the Double Wasp, developing 1850 hp. and rated with a special supercharger as the most powerful aircraft engine in the world at altitudes above 20,000 ft. In this rarefied air this compact unit delivers in excess of 1600 hp. and already has been selected to power some of the new fighters and long range bombers being built for our expanding military forces.

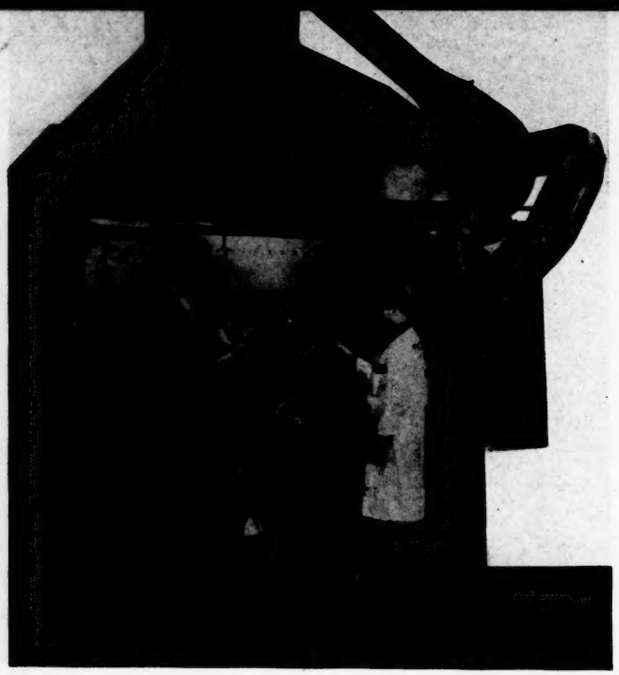
1939 Addition

The 1939 addition to the plant was made to provide manufacturing space for these and other Pratt & Whitney Aircraft engines. The addition is noteworthy not only because of its size, 850 ft. long by 350 ft. wide and 14 ft. from floor to the bottom of roof trusses, but also because of the time of erection. Construction was started during the middle of October 1939 and by the beginning of January 1940 some machines were set up in the building and were operating.

The entire manufacturing section of this addition is located on one floor—there being also a basement of

ARCHITECT, Albert Kahn Associated Architects and Engineers, Inc. HEATING CONTRACTOR, The Jennison Company.

Administration Building and part of plant of Pratt & Whitney Aircraft, a Division of United Aircraft Corporation at East Hartford, Conn.



A kerosene spray booth used for cleaning metal engine parts. Metal pan beneath engine collects kerosene.

Exhaust system for grinding and buffing wheels has ducts run beneath the floor to centrally located fans.

Revolving type Wing unit heaters using 25 lb. steam exhausted from air compressor engines are used for heating.

600 ft. by 100 ft. which is used as a locker room and a mezzanine used to house some offices. Since this addition is in reality an extension on the north side of the older manufacturing building, it has only three walls. These walls are of brick, steel sash and glass with a glass area of about 60%. The roof is of the monitor type with continuous ventilators running the length of the building. The roof itself is of the steel deck type with insulation and tar and gravel waterproofing.

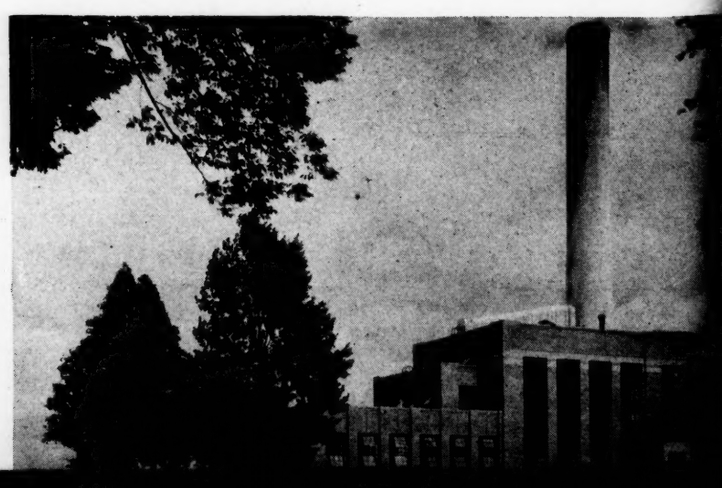
Except for the office spaces on the mezzanine, the entire addition is heated with unit heaters. The majority of these are of the downward discharge, rotating type and are mounted in the roof truss space. However, there are also a few ceiling mounted blast type heaters in special locations. For example, in one corner of the plant there is a large receiving space which has doors large enough to allow two big trucks to enter this section side by side. Even though these doors are closed as soon as the trucks are in the building, a large amount of heat must be supplied rapidly to this area to bring it up to a comfortable temperature in a short time. To do this a large blast heater is mounted on the ceiling so that it discharges a blast of hot air towards this area whenever the doors are opened. In another place blast heaters are used to heat a working space close to the outer walls which is separated from the main floor area by partitions extending about two-thirds the way to the roof trusses. In this case the blast heaters simply discharge a large quantity of heated air over the partition and into the space in the direction of the outer walls.

Exhaust Steam Used

An interesting point about this heating system is that it uses exhaust steam from the engines which drive the compressors. The steam is generated at 160 lb. per sq. in. in a power house which is equipped with three boilers—one with a capacity of 75,000 lb. of steam per hr. and two with a capacity of 50,000 lb. of steam each. The boilers are fired with Bunker C oil.

In operation, a considerable portion of the steam is supplied at 160 lb. to the air compressors and the rest is used for process work and for heating the older buildings. The steam for this latter use is reduced to approximately 25 lb. by pressure reducing valves. The steam for heating the new addition, however, is obtained from the exhaust of the engines driving the compressors and also has a pressure of approximately

Power house which is equipped with three Union Iron boilers burning bunker C oil with Todd oil burners.



25 lb. The steam mains for supplying the unit heaters and convectors in this addition are run in the roof trusses with U bends provided to take up expansion.

The office space on the mezzanine and the locker rooms in the basement are heated by concealed copper convectors. Since the locker rooms are beneath the ground level a complete ventilating and exhaust system is provided.

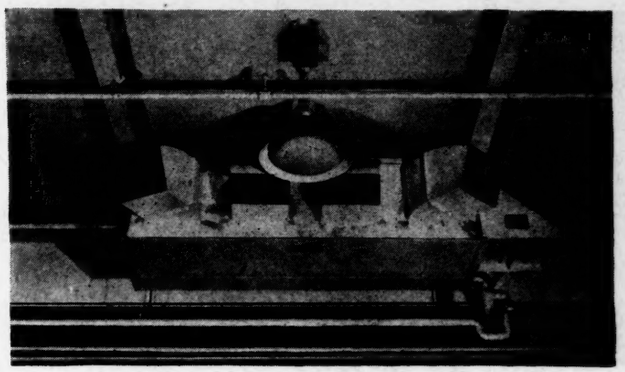
Dust and Fume Exhaust Systems

Numerous exhaust systems for such operations as paint spraying, buffing, grinding, kerosene spray cleaning and caustic cleaning are located on the manufacturing floor. Paint spray booths which are installed with five units side by side are used for painting the various engine parts with a heatproof lacquer. The booths are designed so that the fumes from the spraying operations are drawn to an opening near the floor at the rear of the booth where they are passed through a stream of water which removes about 85 to 90% of the lacquer. The partially cleaned air is then forced by explosion proof, pressure type fans, through ducts to an outlet on the roof. The lacquer is separated from the water and the water is continuously recirculated.

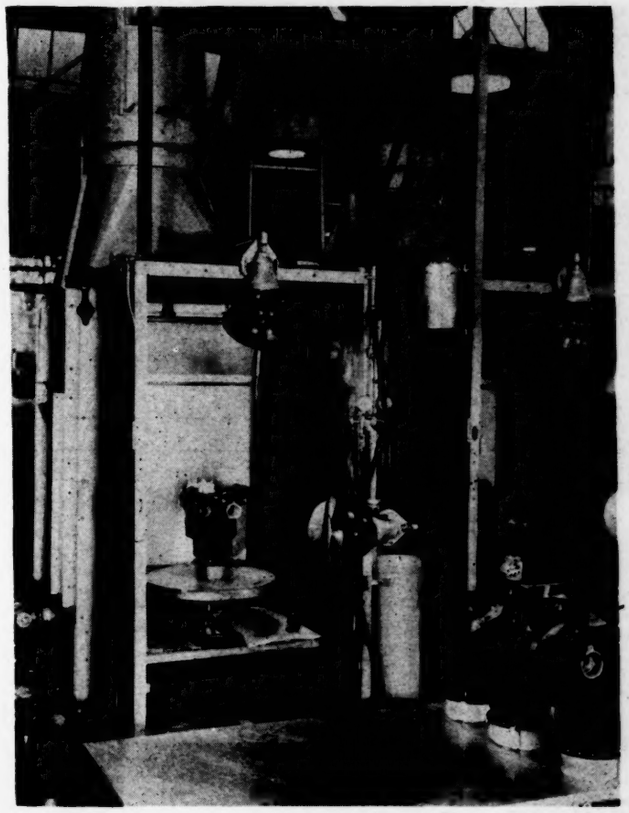
Cleaning of the metal engine parts is accomplished by two methods—a kerosene spray and a caustic solution dip. The kerosene spraying operation is carried on in a simple booth designed to prevent the fumes from entering the plant. The floor of the booth is made of wood strips which, while supporting the part being sprayed at the same time allows the kerosene drops to fall through to a collecting tank below. The kerosene fumes are withdrawn from the booth by a pressure type, explosion proof, propeller fan and discharged through a duct to the roof.

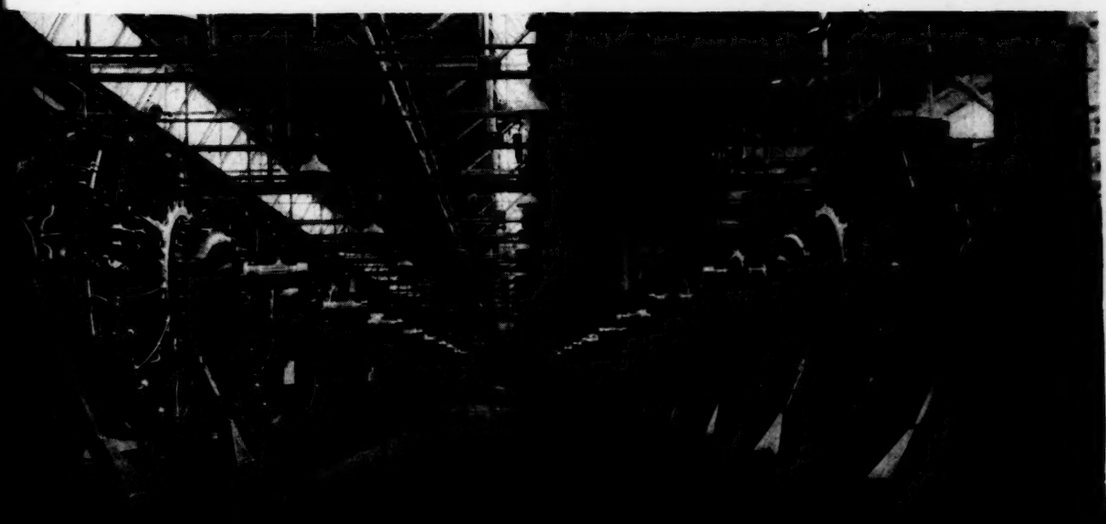
The caustic dipping operation is performed in metal tanks containing the hot caustic solution. Since some fumes are given off by the solution, a simple exhaust system is used for discharging these fumes to the roof. The system consists of a two-inch slot at the back of the tank for removing the fumes, ductwork and a propeller fan with the motor located out of the air stream. All buffing and grinding wheels are provided with semi-circular hoods for catching the abrasive and metal particles. These hoods are connected by means of semi-flexible metal conduit to ducts beneath the floor which carry the air and dust to a blower located in a pit. The blower then discharges the air and dust through ducts to a roof cyclone dust collector.

One of the Sturtevant blast type heaters used for heating large receiving area. Office spaces in the new addition are heated with concealed Trane copper convectors.

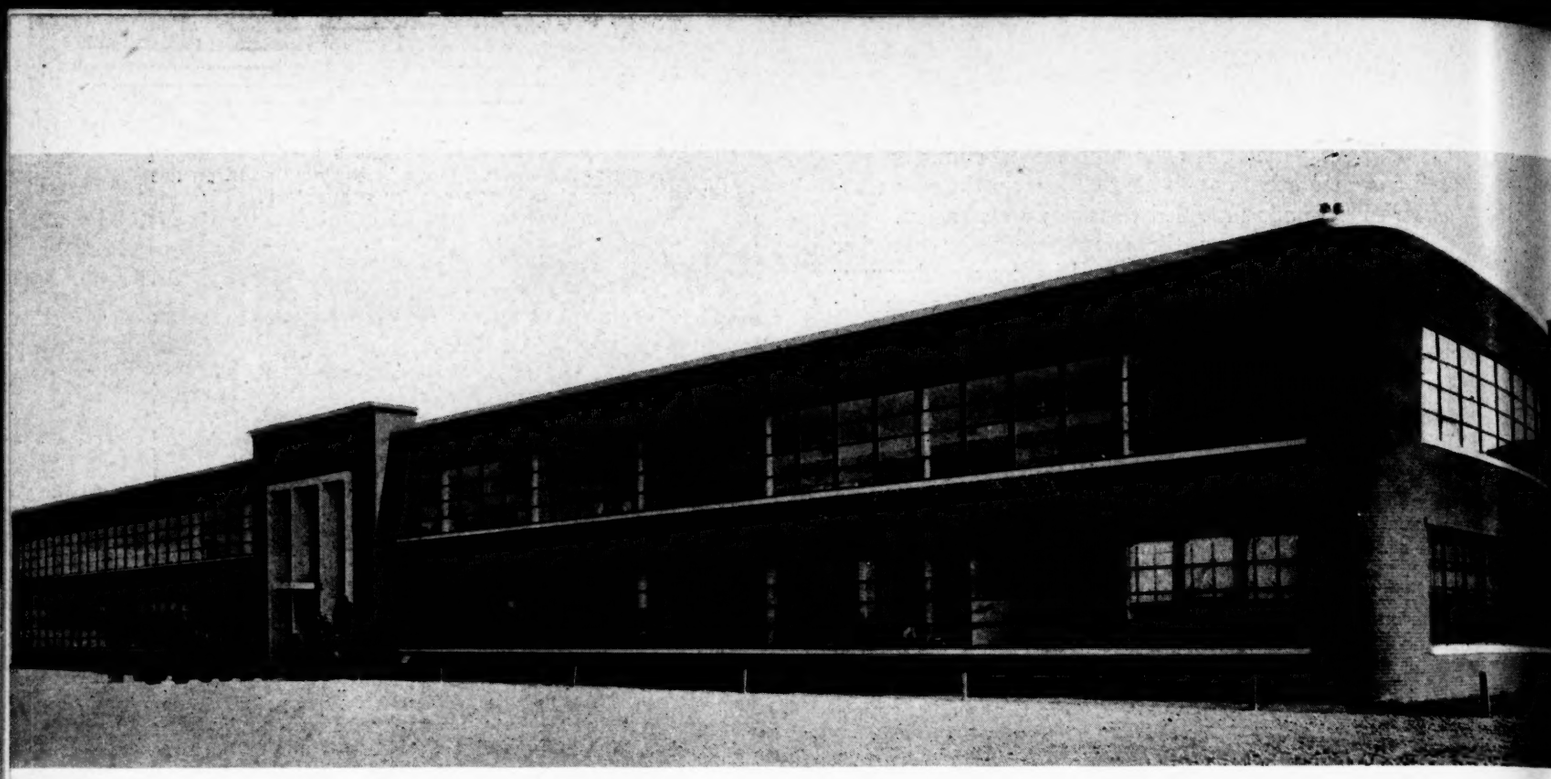


One of the De Vilbis paint spray booths. Heat proof lacquer sprayed on cylinders is removed from exhaust air by passing the air through a curtain of water at rear of booth.





A large group of finished Pratt & Whitney engines waiting for shipment.



STINSON AIRCRAFT

Division of Aviation Mfg. Corp., heats new Nashville, Tennessee, plant with direct fired warm air duct system supplying air through floor outlets.

THE first major aircraft manufacturing plant in the South is the new Nashville, Tenn., plant of the Stinson Aircraft Division of Aviation Mfg. Corp. Other units of Aviation Mfg. Corp. are the Lycoming engine and propeller plant at Williamsport (Pa.) and the original Stinson plant at Wayne (Mich.).

The problem encountered by the architects and engineers involved the sub-assembly and final assembly of the smaller types of airplane on a group basis, for which the principal requirements were clear manufacturing space, uniform daylighting and flexibility of design to permit economical expansion in either the sub-assembly departments or in the main assembly section. In addition to immediate requirements, consideration had to be given to the provision of ample manufacturing space for the largest type of aircraft production and abundant space for constructing larger types as they are developed.

The new plant is located on a 36-acre tract adjoining the Nashville Airport. It consists of a 122,914 sq. ft. factory building with a 20,228 sq. ft. office building, and auxiliary buildings consisting of paint shop, paint storage, wood shop and hammer room, also a sand-blasting unit conveniently located between the fabricating department in the main building and the paint shop. Employment and factory offices are located inside the main factory building which is expected to house more than 1,000 employees.

All incoming material storage departments are so located that after inspection, material and parts can be moved directly into three straight line production departments located in bays of 100 ft. clear span, terminating in the assembly division of the manufacturing unit.

The assembly division is 125 ft. x 300 ft. Large sliding doors 120 ft. wide x 24 ft. high, made in six sections, all sliding in one direction, are located at each end so that the finished planes can be run out on the wide concrete aprons which connect the factory with the airport runways. Balconies provide additional facilities for the sub-assembly of various parts and for storage of manufactured parts to be used as needed in the production lines.

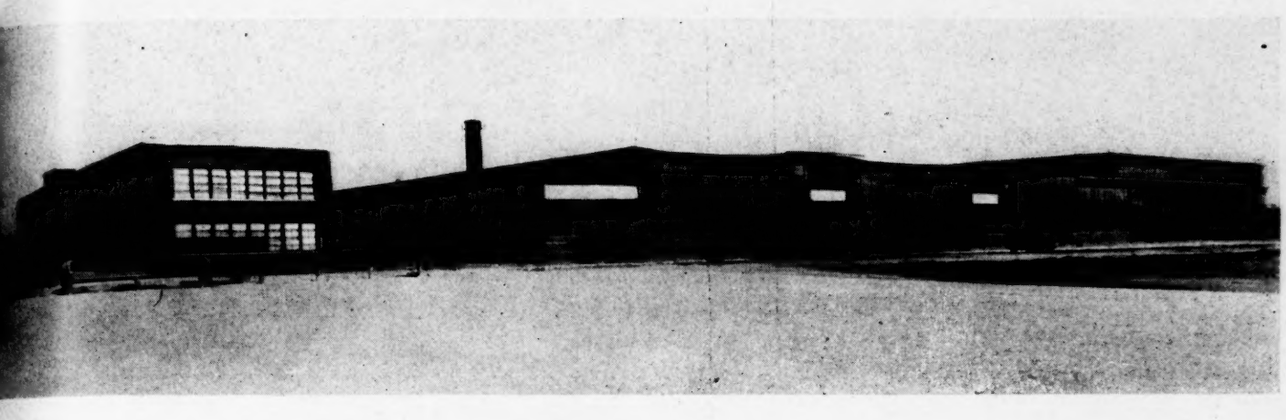
The factory building is 302 ft. wide x 407 ft. long, divided into production department (281 ft. in length) and the remainder devoted to the assembly department. All exterior walls have glazed steel sash and brick curtain walls with gunite spandrel walls between sash and metal roof cornices.

An artist's conception of a Stinson Liaison Observation Monoplane of the United States Air Corps.

Ventilation

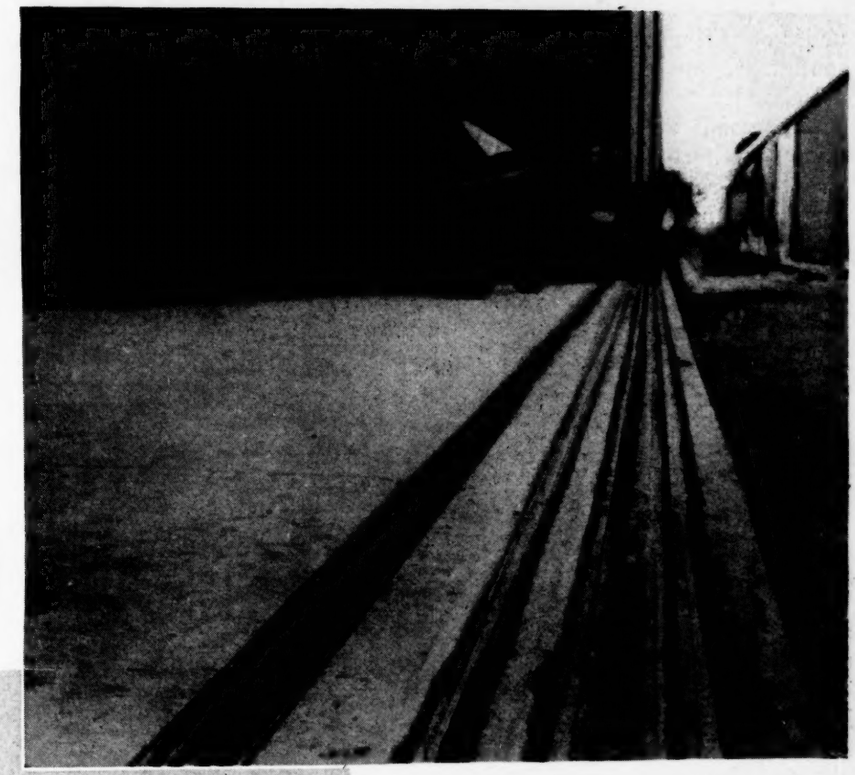
The location and area of the pivoted sash ventilators in the sides of the building and roof monitor allow for complete control of air and the ventilation of buildings

The Stinson office building, air conditioned. General offices are on the first floor, engineering offices on the second floor. (Photo at left)

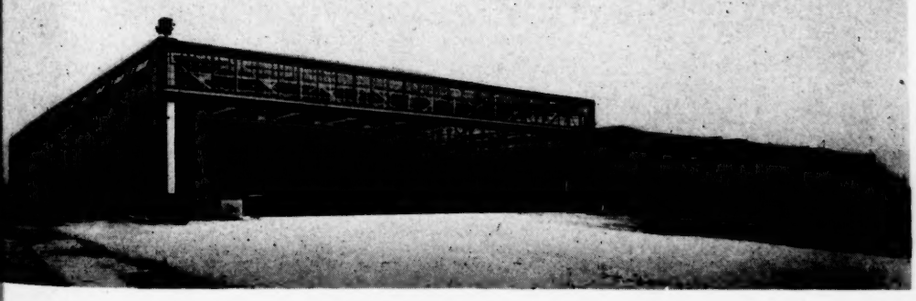


Side view of the manufacturing plant, built entirely of brick and glass with thin steel frames.

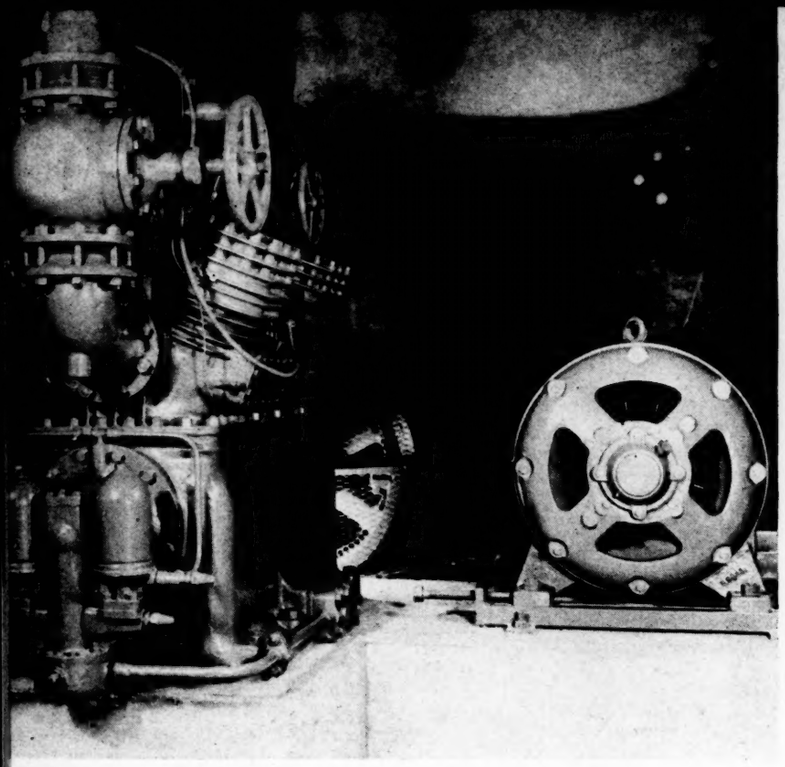
The new Nashville, Tennessee, plant and offices of the Stinson Aircraft Division were designed by Albert Kahn Associated Architects and Engineers, Inc., Detroit.



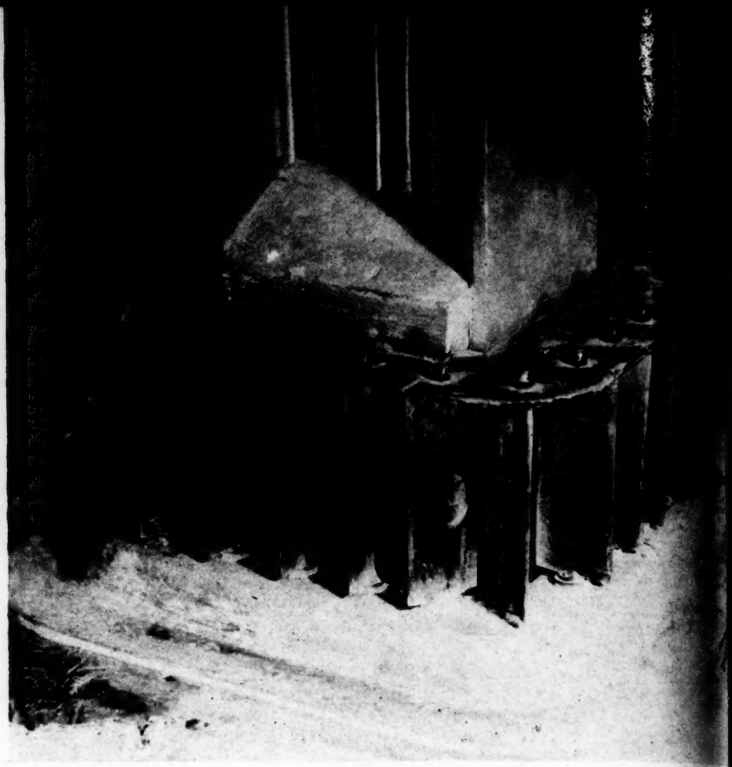
The huge doors in the Stinson plant permit the handling of planes larger than are being made today. The doors created a special heating problem. (Below)



The grille in the floor at the huge door which supplies a curtain of warm air to blanket the door opening. (Above)



Condensing unit for the air conditioning system which cools the office building during the summer.



Column footing in the Stinson plant, showing the warm air supply at the floor. Vanes direct flow of air.

under normal circumstances. The sash in the west and south elevations, including the south sides of monitors, are glazed with a special non-glare heat-resisting glass.

The roof is of monitor type with side pivoted ventilating sash so arranged that the ample glass area gives uniform intensity of daylight throughout the working plane of the large floor area.

Factory Heating

The factory is heated by a circulating warm air system and during all seasons of the year air is circulated. The warm air is distributed throughout the building by means of underground concrete ducts, with flush type outlets located in the floor along the outside walls and column type outlets at the base of the center building columns. Excessive infiltration is counteracted at the large sliding doors in the assembly department by a curtain of warm air which rises from a full length grille located in the floor at the foot of the doors.

This system is so arranged that a fresh air supply, recirculated air from the building, or both can be returned to the heater rooms through return air openings located on floor line at each of the heater rooms. Damper controls allow for the recirculating of air from the building, for outside air to be taken in from the outside, or for any proportional mixture of the two. All the recirculated or outside air drawn into the heater rooms by the blowers passes over the heater, recovering any heat lost by radiation, and before being forced through the heater into the distributing duct system. The system is automatically controlled.

Two 60,000 c.f.m. brick set tubular, direct-fired warm air heaters, each capable of delivering 6,200,000 B.t.u. an hour, with an overload capacity of 20% for short and warming up periods, are provided to heat the factory. Both heaters, which are stoker-fired, are located in pits below the floor level.

Administration Building

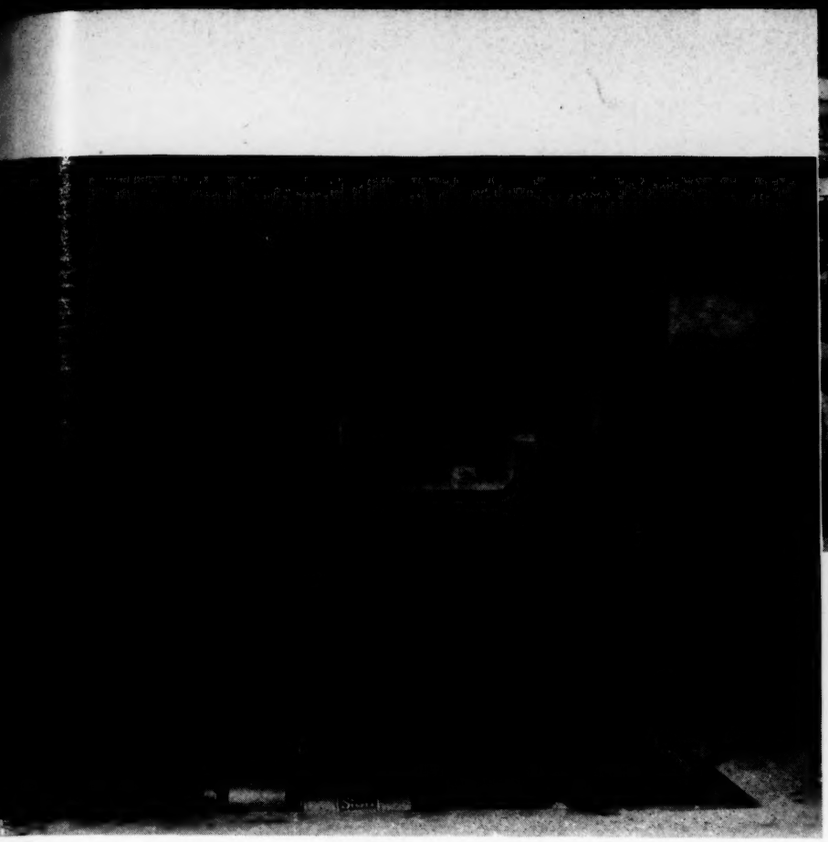
The Administration Building, which houses the executive and engineering offices, is in front of and connected to the factory portion by a covered 10 ft. wide passageway. It is 42 ft. x 242 ft., and two stories in height.

This building is heated by a combination of forced circulation hot water radiators and warm air system; the latter consists of a duct system with hot water coils.

The air is supplied to the building at room temperature through the duct system, the hot water radiators being used to overcome the heat losses only. The temperature of this hot water is governed by a dual control with one bulb mounted outside and the other in the hot water supply to the building. When the temperature outside is, say, plus 30F, the water temperature would be approximately plus 70F to maintain a given temperature of 70F in the building. As the outside temperature drops, the water temperature uses and maintains the same differential between the inside and outside temperature in the building.

The water for the system is heated by means of a welded steel hot water boiler located in the same pit as the factory heating plant. Centrifugal pumps circulate hot water to the office building radiators. This boiler is fired by a forced draft stoker. As the dual control calls for heat, the stoker combustion rate is stepped up until the control is satisfied, when it drops down to idling speed again.

The hot water mains are run overhead through the factory and across the connecting passage to the basement of the office building, where branches are taken off to supply the heating coils in the ventilating system before rising to the first floor ceiling where the mains are run above the suspended ceiling to supply the radiators in the offices.

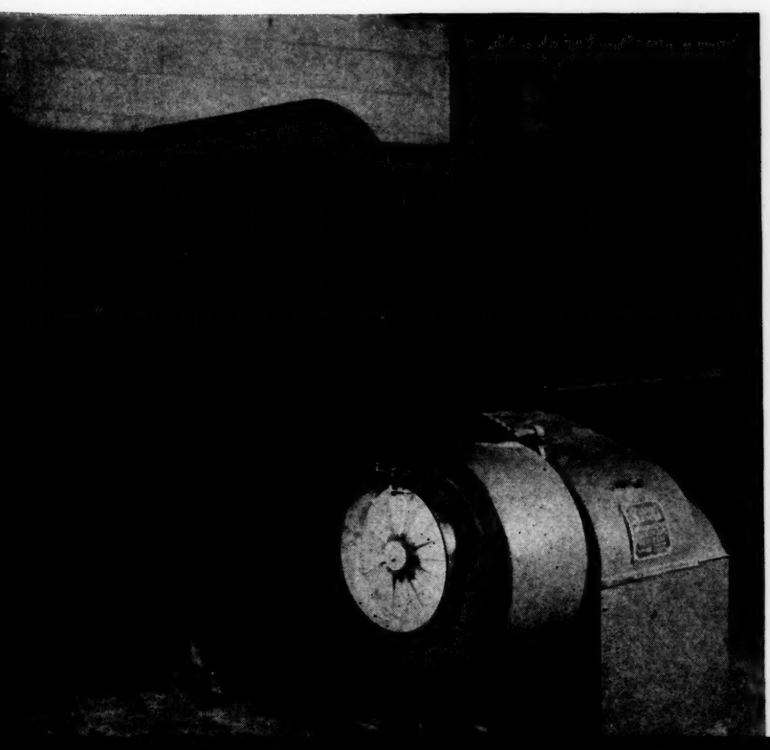


(Above) Assembly room in the Stinson plant, showing thirty of the Stinson 105's in various stages of completion. The first commercial plane built in Tennessee was recently completed here. (Left) Skelly stoker and Spencer hot water boiler which serve the office building heating system. Both direct radiators and a duct system are used for the offices, the latter taking care of the wall and glass heat losses only.

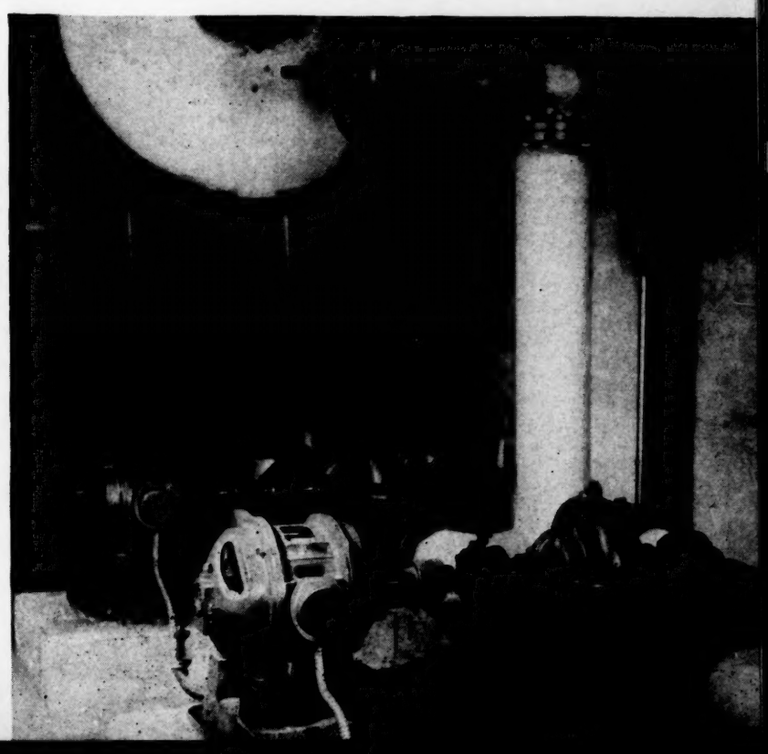
The air conditioning system includes a compressor located in the basement, supplying direct expansion coils. The air is filtered. The system is designed to maintain a ten degree reduction in outdoor temperature and a ten degree dewpoint depression. The system of damper control is so arranged that one hundred percent of outside air can be taken in, or one hundred percent can be recirculated. By manipulation of dampers any quantity can be introduced into the office area.

The method of cooling the condenser water for the air conditioning refrigerating machines is somewhat unusual. For fire protection purposes a very large underground storage reservoir has been constructed. Condenser water is pumped from the bottom of this reservoir through the condensers and returned to a series of sprays mounted on the reservoir roof. Holes in the roof permit the water to return to the reservoir. During the night, when the air conditioning system is not in operation, the condenser water pump can be used for pumping the water from the reservoir through the sprays in order to reduce the temperature of the water in anticipation of next day's requirements.

Skelly stoker, using soft coal, fires the Lee brick set heater for supplying heat to the plant.



Chicago pumps circulate the hot water through the office building heating system.



ALLISON DIVISION,

General Motors Corp., places in operation a completely air conditioned windowless factory using a combination of well water and mechanical refrigeration for air conditioning.

Above, a U. S. Army Bell pusher type plane powered by two glycol-cooled 12-cylinder 1000 hp. Allison engines.

THIS INSTALLATION

The windowless factory described here is located in Indianapolis, Indiana. Architects and engineers were the Austin Company, in cooperation with the owner. Air conditioning was designed by Air & Refrigeration Corporation.

A COMPLETELY air conditioned and artificially lighted, windowless factory has been put into operation at Indianapolis by the Allison Division of General Motors. Outstanding features of the building include:

(1). A combination of well water and mechanical refrigeration for summer air conditioning;

(2). The first application of a new type of fluorescent lighting, with low heat emission, to a large scale industrial lighting problem, duplicating mid-day north light 24 hours a day;

(3). Low power consumption due to the combination of heat insulation, air conditioning and artificial lighting;

(4). Tie in of the factory's Diesel power plant with local utility electric lines;

(5). Striking architectural effect, due to the windowless feature and use of glass brick panels, and

(6). An unusual tooling set up for precision work.

According to Allison officials, the company's program for the manufacture of Army aircraft engines calls for a high degree of precision and careful handling of materials. Temperature changes affect the micrometric

gauges and precision machines workmen are constantly using. Perspiration may cause etching on a highly polished metal surface, sometimes from just a sweaty finger print, they report. Unusually fine lighting is required for accurate reading of gauges and observance of work by operators. Comfort of workmen is unusually important because of the concentration and skill required.

It was apparent when the plant was laid out that maintenance of a steady, comfortable temperature, proper humidity, and low dust count in the manufacturing building would be essential. Since air conditioning and artificial lighting were required it was possible to dispense with windows and monitor roofs, which contributed to economical construction.

The new plant is located in Speedway, a suburb of Indianapolis. Four new buildings on 53 acres of land comprise the plant. They include the manufacturing building with adjoining office building, a test building and a gate house. Construction is of brick, steel, concrete, glass brick and Indiana limestone trim. The windowless manufacturing building is painted aluminum throughout the interior. A large receiving room, not air conditioned, at one side of the Manufacturing Building's main room, and other entrances serve as air locks so that unconditioned air does not rush into the air conditioned area when outside doors are opened.

The three-story office building also is completely air conditioned, although it is not exclusively artificially lighted. This building houses executive, engineering, accounting and general office personnel. It includes a doctor's office and hospital and first aid room. Its entire third floor is devoted to a cafeteria.

The test building is a series of rooms with large open sound-proofed stacks. Propellers on engines on test pull the air in through one stack and push it out through another. A small structure, in which propellers used with the engines on test are balanced, adjoins the test building.

The manufacturing building is equipped with the first large scale application of a new type of fluorescent lighting. Each lighting unit is equipped with three 40-watt lamp bulbs, 48 inches long and one and a half inches in diameter. The inside surface of the lamp tube proper is coated with a fluorescent material and the lamp filled with mercury vapor, so that light is produced by fluorescence, activated by an electric discharge within the gas-filled interior. The color of the light produced by these units is so close to daylight that it is practically impossible for the laymen to detect any difference. Its glareless quality is not only more beneficial to workmen's eyes but also a distinct aid in production.

One of the most interesting features of the new lighting is its lack of heat. The new tubes, while giving much better light than ordinary bulbs, emit only one-third as much heat. One of the lighted tubes can be held in the hand without discomfort. This contributed to a reduction of about one-third in the necessary air cooling capacity.

Because of the nature of the plant's work and the fact that air conditioning and artificial lighting are vital, an uninterrupted flow of economical electric power is essential. This is assured by one of the first electric power hook-ups of its particular kind and magnitude installed in the United States.

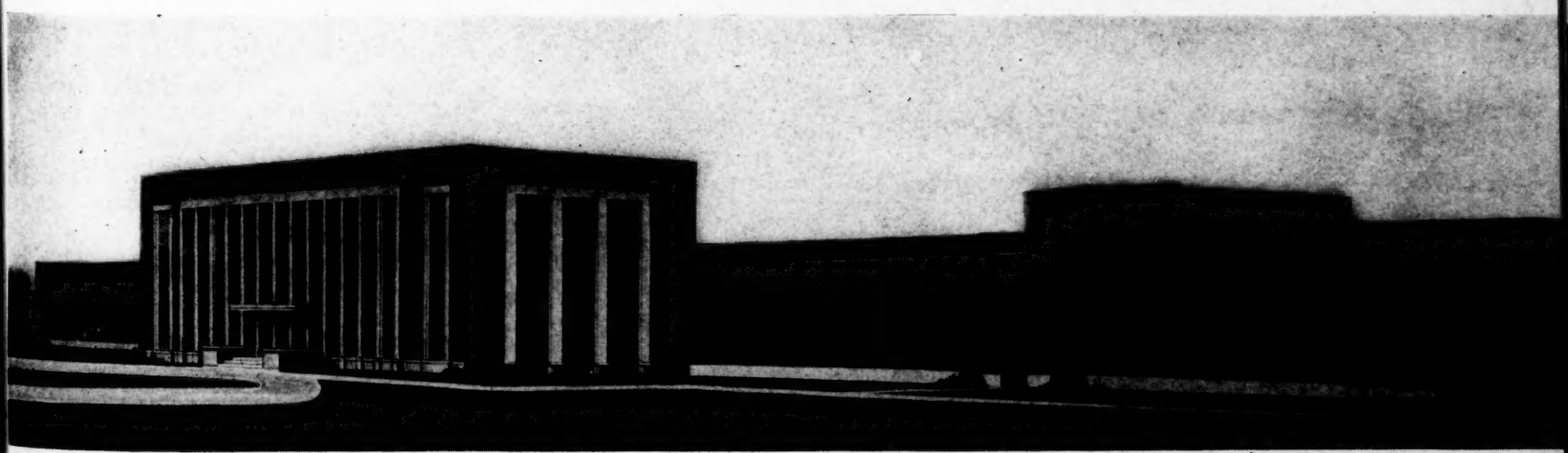
By the use of the plant's own battery of transformers it has been possible to parallel the power lines of the local electric utility with the plant's own Diesel power plant. This is the first instance of record in which the two sources of power are so hooked into an industrial enterprise that upon a moment's notice the total plant requirements can be taken off of either, or part from one source and part from the other, as economy or emergency dictates.

The power plant is one of the largest Diesel plants attached to an industrial enterprise in this country. It consists of two 16-cylinder V-type, two-cycle Diesel engines and two 6-cylinder V-type, two-cycle Diesel engines.

All electrical control apparatus and the oil burning boiler which supplies heat for the plant are located in the power plant.

For the promotion of greater workman comfort and health and better precision work the forging and casting cleaning department is equipped with a metal dust

Fig. 1. The new property in Indianapolis of the Allison Division, General Motors Corporation, plant.



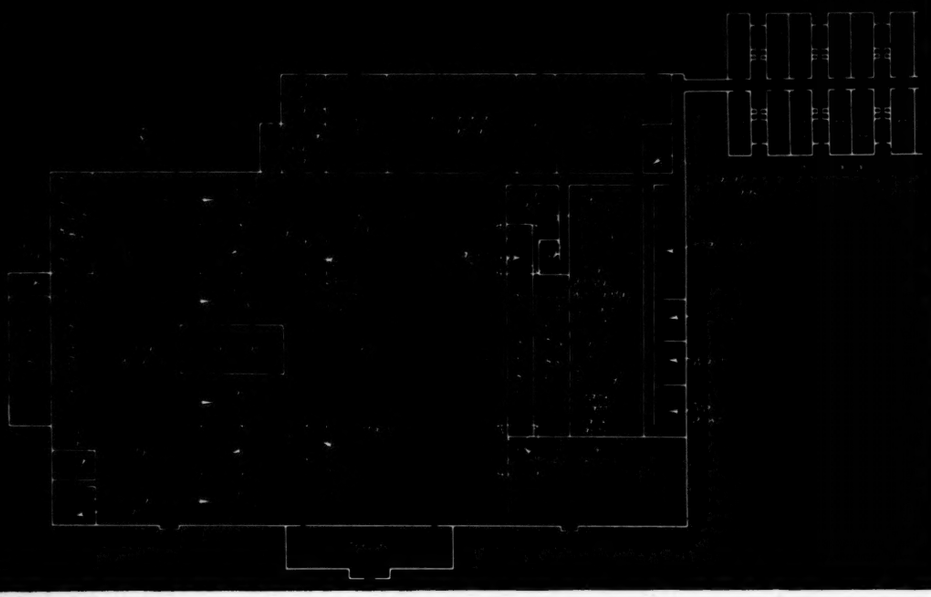


Fig. 2. Plan of the Allison Division plant. All parts of this building except the receiving room are completely air conditioned. Eight separate systems are used for conditioning.

exhaust system. The workmen sit at a long metal table upon which the machinery is placed. A slot is located along the front edge of this table. A central blower draws all small metal particles across the table surface down into tubes to a central exhaust main which carries the dust off to a discharge into the atmosphere. Since the conditioned air enters the room at the top, and the exhaust slots on the tables are below the workman's face and at about the level of his waist, the pressure differential results in a positive movement of conditioned air past the workman's face, in addition to carrying the dust particles away from him, so that it is next to impossible for dust to get to his nose.

Designers of the air conditioning system for the main plant decided that an effective temperature of 78F should be maintained in the summer in that building, so that with outside conditions of 95F dry bulb and 78F wet bulb and a sun effect such as prevailed in Indianapolis, the maximum inside conditions, when operating at full capacity, should not exceed 85F dry bulb and 72F wet bulb, corresponding to 53½% relative humidity and a 78F effective temperature. The system was designed to maintain 70F in the winter when the outside temperature is + 10F. The internal heat load includes an average of 1000 occupants, 1440 horsepower in motors, and 250 kw. of lights.

It was calculated that 90,000 c.f.m. of outside air would be required under minimum conditions to maintain an outward pressure and to provide sufficient air for ventilation and the dilution of oil fumes which might arise from the machines. All these factors created a cooling load under maximum conditions in the summer of 815 tons. The required inside conditions represented a saturation temperature of approximately 66F so that the air delivered into the factory under maximum conditions had to be saturated at this temperature. Consequently, the allowable rise to maintain the conditions specified was about 18½F. With this rise and a sensible heat gain of approximately seven million B.t.u. per hour, an air volume of 400,000 c.f.m. was necessary.

To provide for possible breakdown the air conditioning plant was made up of eight identical systems. Each one has a capacity of 52,000 c.f.m. Since the amount of air required for summer cooling was more than sufficient for winter heat, the system was designed on the basis of summer cooling.

It was shown by the designer that if complete evapo-

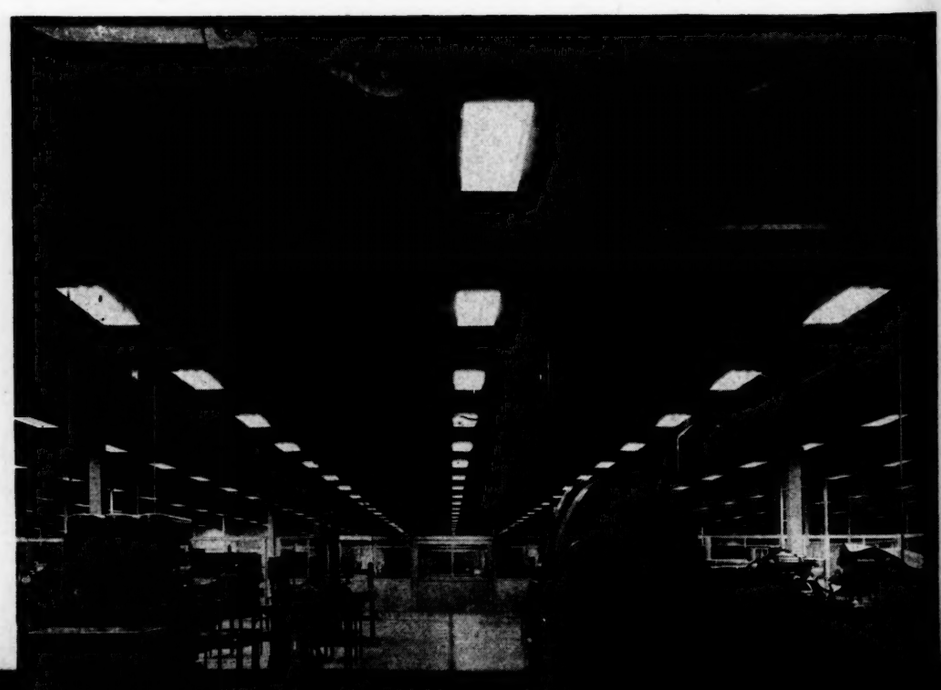


Fig. 3. Interior view of the plant showing the new type of fluorescent lighting which gives five times as much light with only seven-tenths as much electricity required as older types of factory lighting.

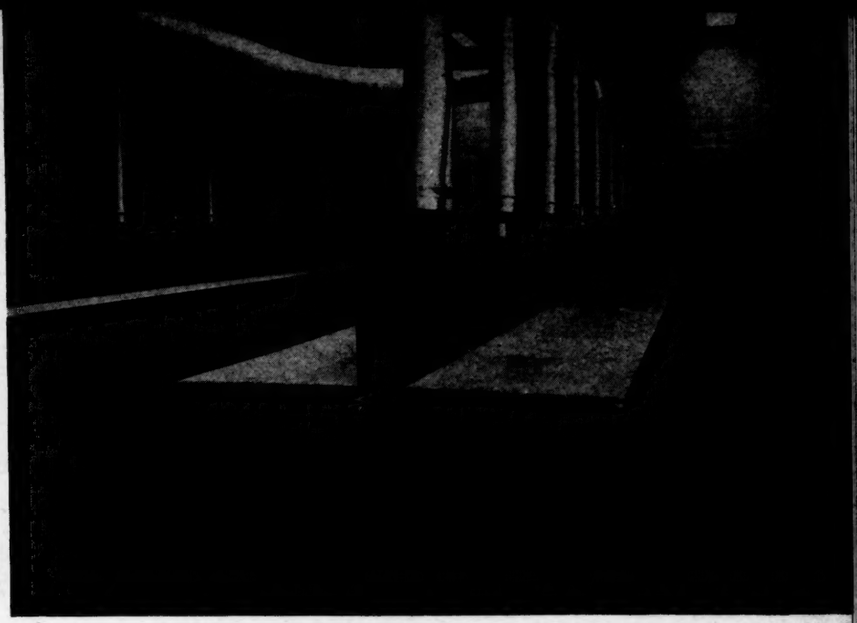


Fig. 4. Casting cleaning room. Note slots running down edge of metal tables. Dust from grinding machines is drawn through this slot away from the breathing area of the workmen.

ration could be accomplished, evaporative cooling could be used to produce the necessary results, without the use of refrigeration, during a large proportion of the operating time.

The eight evaporative type conditioners installed are capable of both cleaning and saturating the air at the wet bulb condition of the entering air. These units were installed in penthouses on the roof. They were installed in pairs, four penthouses being erected in which to house the eight systems. The units were designed so that with a change in the outside wet bulb more or less outside air could be taken into the building; in other words, as the wet bulb fell to a point below 66F, all outside air could be introduced, or a mixture of outside and recirculated air could be introduced into the washers to maintain the required leaving dew point.

Substantial power saving is effected by the relatively small quantity of water required for saturation of the air and the low pressure required for the distribution of the water over the capillary. For simple humidification and evaporative cooling 2½ gallons of water are required at 6 lb. nozzle pressure per 1000 c.f.m. handled, as compared with from 15 to 20 g.p.m. per 1000 c.f.m. when the water is atomized at from 20 to 25 lb. nozzle pressure ordinarily required.

The penthouses were so arranged that they not only acted as mixing chambers for recirculated and outside air, but have automatically controlled louvers which act as relief dampers, through which the excess air taken from inside can be relieved to the outside atmosphere.

Fans for delivering air to the eight systems are of the backward-curved type, single width, single inlet, down-blast discharge, discharging directly into the distributing system underneath. These fans are driven through belt drives by 30 hp. motors. Since the coils are used for both heating and cooling and, consequently, must be protected from direct moisture, two sets of eliminators are required with one set of coils. The one set of eliminators prevents entrained water from lodging on the coils when they are being used for heating purposes, which might occasion over-humidification. The second set of eliminators, used only in the summertime, prevents condensate from the air deposited on the coils from being carried out to the system.

Each fan discharges into a practically identical duct system of the simplest type, but special diffusing and adjustable outlets permit a uniform distribution over

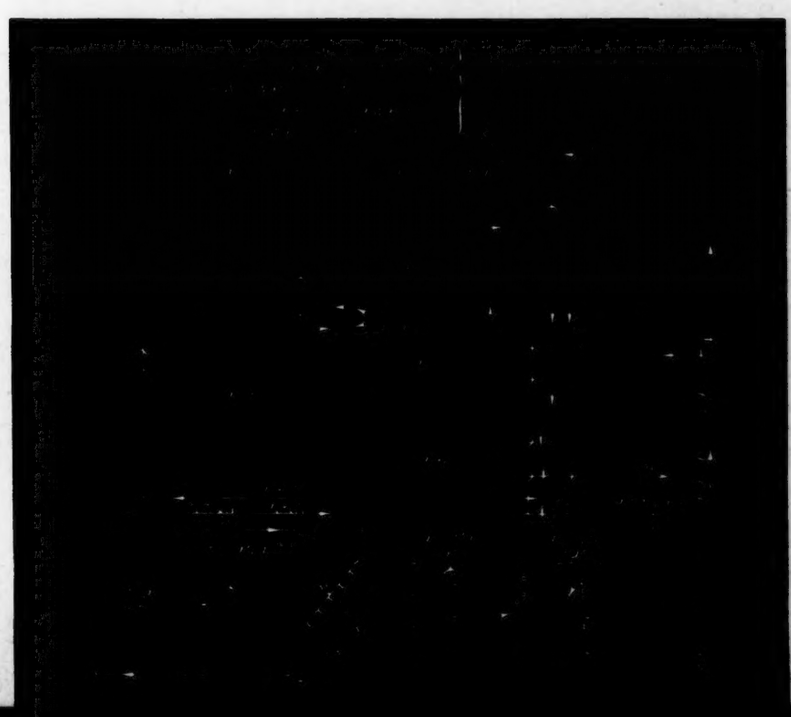


Fig. 5. A schematic diagram of the arrangement of air conditioning equipment, indicating the circuits of refrigerant, well water, hot or cold water through coil, spray water and Diesel jacket cooling water. The drawing is not to scale and is intended to portray the general idea rather than the details.

the entire working area. As the system of supply is uniform, no return duct system is necessary, and the air returns to the penthouse by the creation of a pressure in the room, for either recirculation or for relief into the outside air. The fans, coils and conditioners, motors and pumps are mounted on concrete and cork foundations to eliminate both condensation, dripping and vibration.

Air is cooled by interchange with coils through which cold water is circulated when the wet bulb rises above the required point. The coils were designed so that in the winter they can also be utilized for the circulation of hot water to heat the air.

For producing the necessary cold water circulation, reciprocating compressors are employed. As this plant was to be operated by Diesel engines, jacket cooling and condensing water were essential for the operation of the plant, and as the territory in which this plant was erected abounded in gravel strata well water around 54F, it was decided to dig wells to supply this cold water for air cooling, condensing purposes, and for jacket cooling.

A heat balance investigation indicated that if the well water was first used for air conditioning purposes its temperature on leaving the air conditioning system would still be amply low for condensing purposes and, after, for jacket cooling for both the Diesel units and production test. However, it was found that the average water from wells in this territory was of such hardness that coils first subjected to cold water of this nature and then to heat were likely to deposit their carbonates throughout the system. Therefore, this cooling water is used only indirectly and to circulate through the system both cold and hot water in a closed system, the same water being used for heating and cooling and being taken through an interchanger for cooling purposes (or directly from the hot water boiler for heating purposes), and by-passed either automatically or by hand, according to the season or the prevailing conditions. On investigation, it was discovered that 1350 gallons of 54F well water were available, and the water taken through an interchanger would cool water coming back from the air conditioning system at 64F, to 59½F, and the water would still leave the interchanger at a condition of 60½F, which would be amply cool for condensing purposes and for jacket cooling. Moreover, it would reduce the required refrigeration effect to be obtained from the refrigeration machines from 815 tons to 575 tons. Water having been found in the necessary quantities, only 575 tons of refrigeration were installed in compression machines, driven either by Diesel or electric power. These compressors are uniquely connected to the Diesel and motor drives so that the Diesel engines for driving the compressors can be used to drive the motors as generators to supplement the electric capacity of the plant.

The system of control is such that, automatically, the amount of outside air introduced into the system is varied from a minimum of 90,000 to a maximum of 400,000 c.f.m., depending on the outside wet bulb. The amount of refrigerated water is automatically regulated to produce 66F saturated air leaving the coils. The return air dampers are regulated in opposition to the outside air dampers, so that when the outside conditions permit the introduction of large quantities of outside air, recirculation into the system is prevented and the air is relieved through automatic louvers in the penthouse.

Heating for winter is obtained through an oil burning hot water boiler, the quantity of water circulated being determined by the leaving temperature of the air at the apparatus.

There are a number of adjoining buildings which were considered in the analysis of the entire project. One of these is the Office Building, which is conditioned to a lower effective temperature than that maintained in the main factory section. This system, which required 21,000 c.f.m. of air and which was to be maintained at a 73F effective temperature, is taking its air from the main system, hooking into the lateral distributing ducts of the main factory. The system is zoned for heating and has separate heaters in its own distributing system. The air from the Office Building is returned by fans into the main factory section. The only other section of the building which required air conditioning was the Paint Shop, and this section, isolated from the main factory, had its own air conditioning unit, with none of the air recirculated.

Other adjoining buildings, not requiring air conditioning and not being of the windowless type, are not conditioned, but are heated and ventilated by unit heaters.

Fig. 6. Compressors for the air conditioning system can be driven either by Diesel engines or electric motors. Electric motors can be made to serve as generators when cooling is not needed.

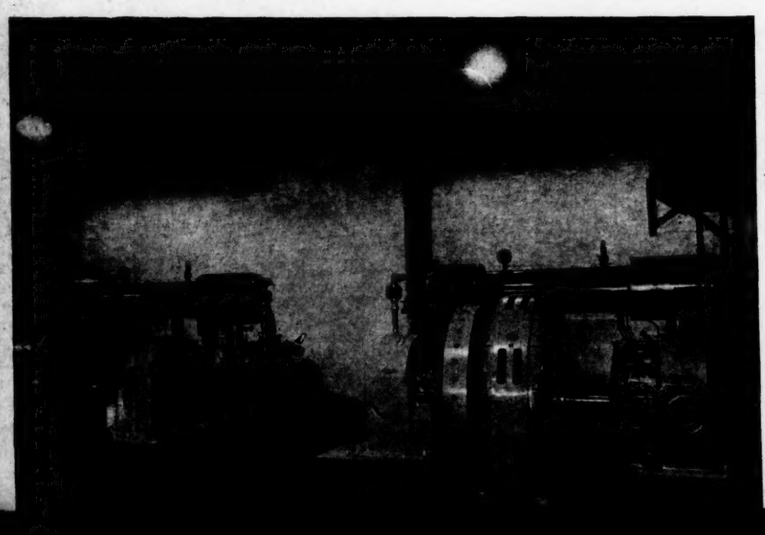
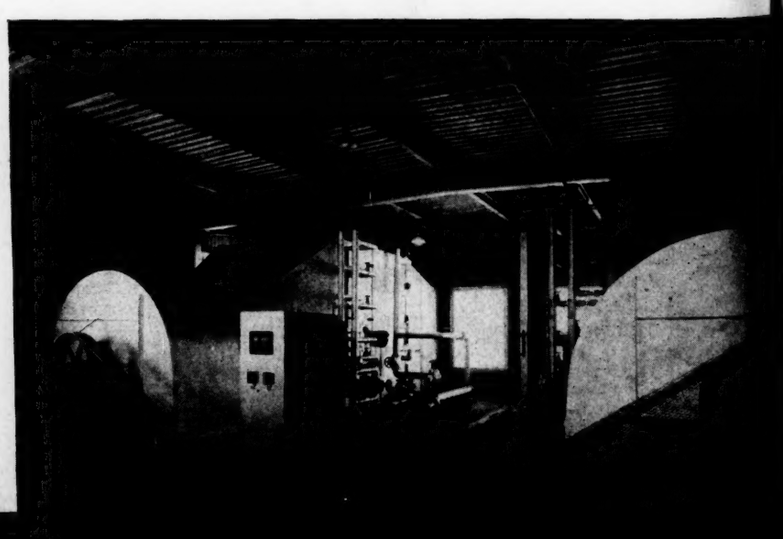
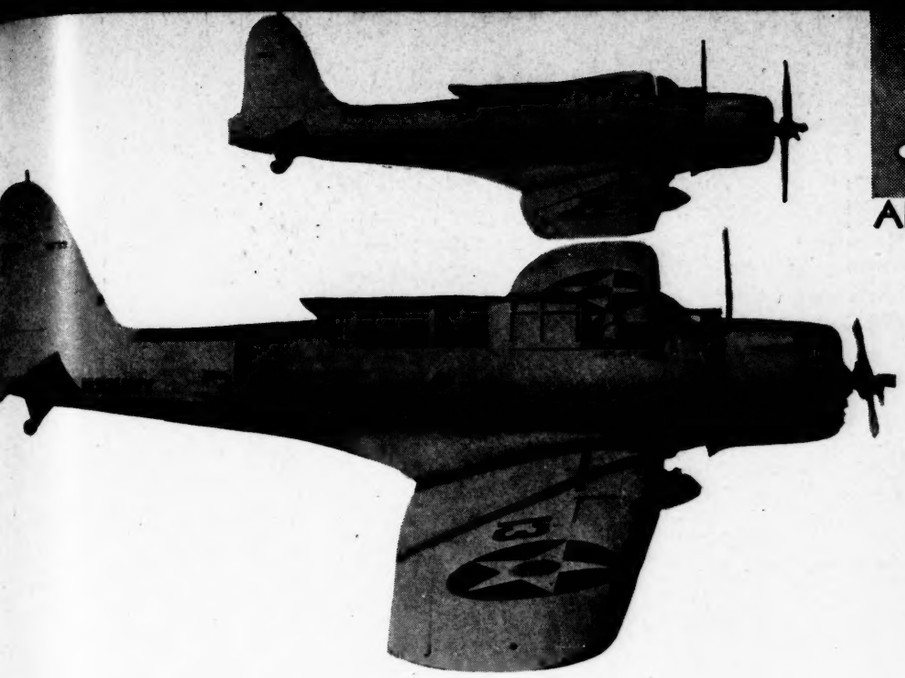


Fig. 7. One of the air conditioning penthouses atop the plant. Eight separate conditioning units are located in four such penthouses.





AIR CONDITIONING FOR AIR DEFENSE

The three new additions to the Vought-Sikorsky plant at Stratford, Conn., were designed by Albert Kahn Associated Architects and Engineers, Inc., in conjunction with the engineers of Vought-Sikorsky Aircraft. The heating contractors were the Mitchell and Bailey Co., and Edwin Moss & Sons, Inc.

VOUGHT-SIKORSKY AIRCRAFT

Division of the United Aircraft Corporation at Stratford, Conn., uses both projection and blast unit heaters to heat its three new additions.

VOUGHT-SIKORSKY Aircraft, a Division of the United Aircraft Corporation at Stratford, Connecticut, is today one of the most important suppliers of observation scouts, scout bombers, and scout observation airplanes for the United States Navy. In addition, this plant is also supplying the American Export Lines with luxury air liners which will be the first trans-oceanic flying boats built for non-stop operation over the Atlantic.

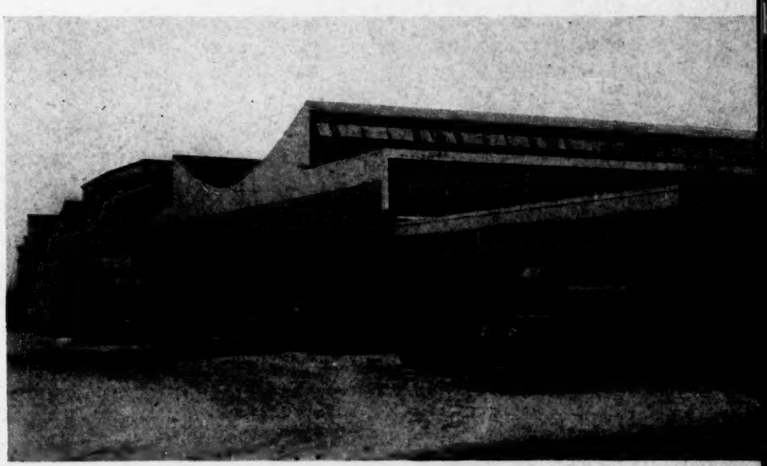
This organization is a combination of two former divisions of United Aircraft-Chance Vought Aircraft and Sikorsky Aircraft, both of which have been long famous in aeronautical circles.

Chance Vought Aircraft was one of the pioneers in the development of airplanes for the United States Navy and supplied the first service type planes to be catapulted from a battleship and the first to operate from the deck of an airplane carrier. For more than 20 years Vought has supplied planes for naval aviation.

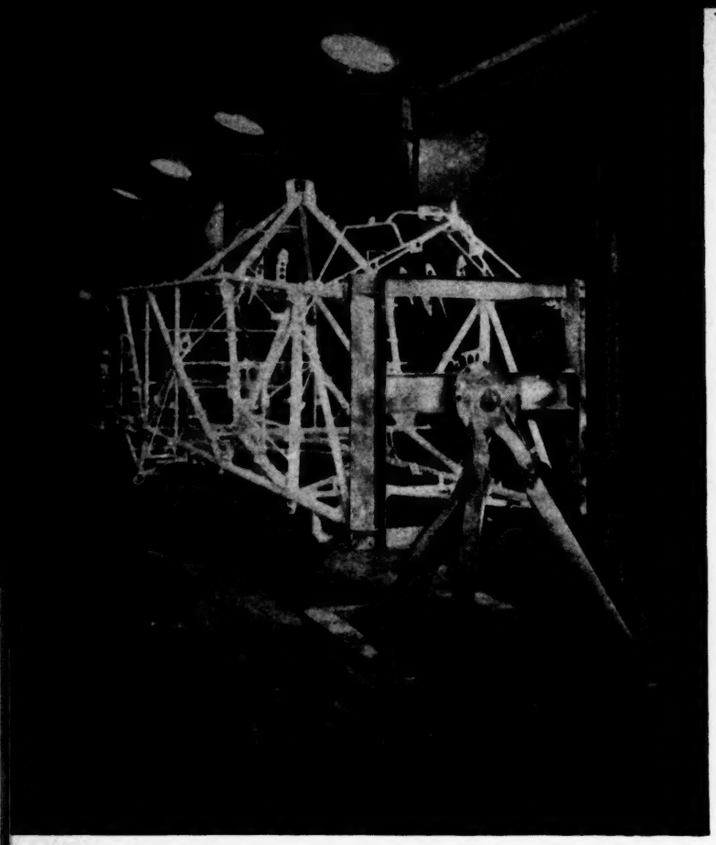
Sikorsky Aircraft is famous for its pioneer work in metal construction of airplanes and has done much to further the art of both amphibian and flying boat design. The organization is also well known for its design of the 20-ton flying boat for Pan-American's Pacific air service. This Sikorsky S-42 Clipper established ten world's records and showed that large size flying boats were practical. Sikorsky Clippers have blazed the trails across the Pacific to the Far East and Australia, across the Atlantic to Bermuda and Europe and are now in daily passenger service both in this country and abroad.

Recent Expansion

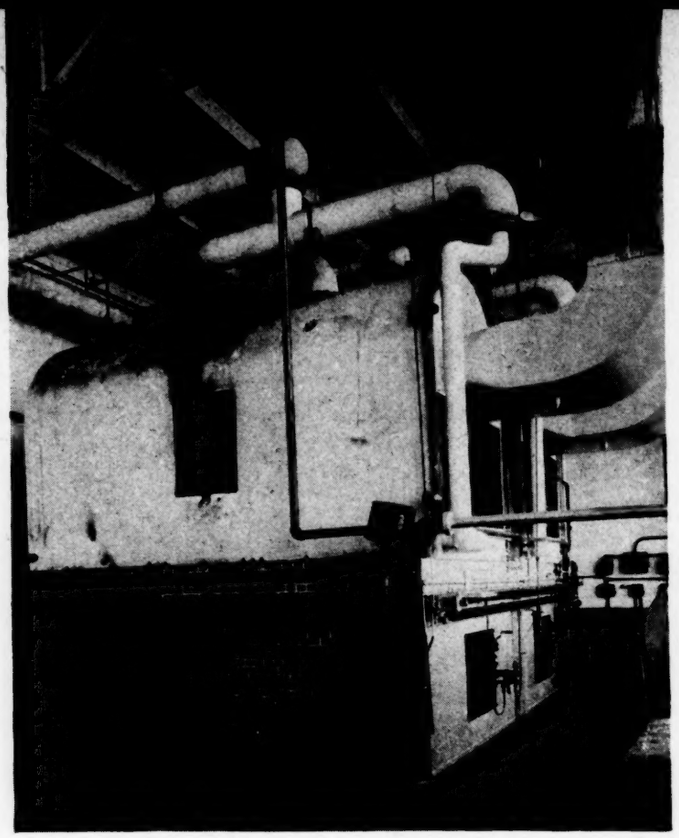
Due to the recent national defense program and to the demand for the company's products, Vought-Sikorsky Aircraft has had to expand its plant three times within the last year. The first addition was made during the early part of 1939 and was approximately 250 ft. by 450 ft. in size with a clear working space of from 20 to 26 ft. from the floor to the bottom of the roof trusses. The second extension to the plant is approximately 60 by 160 ft. and is used as a drop forge shop. The latest addition was designed originally for



New addition to manufacturing building of Vought-Sikorsky Aircraft, a Division of United Aircraft Corporation at Stratford, Conn. Unit heaters are used in this section.



Metal spraying booth in which air is exhausted through openings around wall plaques and in ceiling. Paint spray booth construction is similar. Note enclosed lights.



Two International boilers fired by Todd oil burners burning bunker C oil used for heating new additions. Boilers generate steam at 10 lb. pressure and rated at 225 hp. each.

storage space, although it is now used as a shop. This is a two-story structure on the east side of the plant and is approximately 77 ft. by 302 ft. in size.

All of the additions are of structural steel, steel sash and brick. Roofing of these buildings is the mill type which is made up of two-inch thick wooden planks covered with tar and gravel waterproofing. The roof of the largest addition is of an unusual design, and is of an inverted semi-circular shape with a large amount of glass area on the slanting sides leading up to the semi-circle.

Heating

The heating of these additions is of interest because the systems are good examples of up-to-date industrial plant practice. In all of the manufacturing spaces unit heaters are used—the particular type depending on the location and the service. In the portion of the plant where heating is required to overcome the heat loss of the roof and to warm the air, vertical downward discharging projection heaters are employed. The areas heated with these units are the entire two-story addition and the center portion of the main extension other than the crane bay area. Mounted beneath each projection heater is a deflection cone which helps distribute the warmed air over the area to be heated.

Crane Bay Area

Since the crane bay area must be kept clear to allow the crane to operate, blast type heaters are located in the roof trusses at the side of the bay. There are six of these heaters serving the crane bay area and each is equipped with three nozzles to distribute the air evenly over this area.

At the north end of the crane bay is a set of doors approximately 80 ft. wide by 25 ft. high. To help bring the adjacent areas back to the proper temperatures after these doors are open, two large blast heaters equipped with two-directional nozzles supply heat to this area.

Since the north wall of this extension has a large heat loss due to the glass area and exposure, four blast heaters blowing in four directions are provided to heat the area adjacent to this wall.

In the drop forge shop two double horizontal blowing unit heaters, one located at each end of the shop, are provided for heating.

Cafeteria

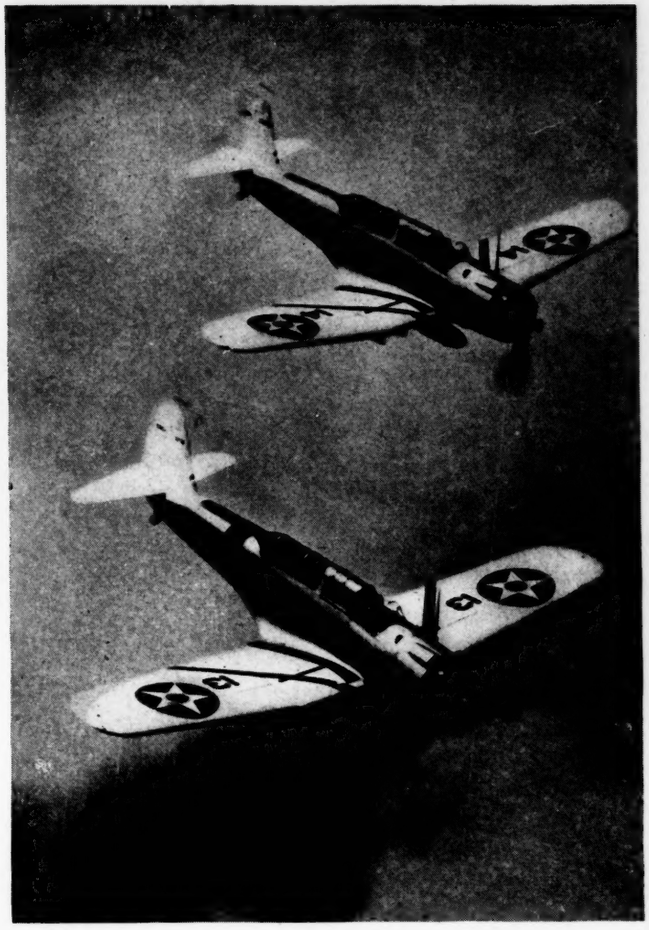
The west side of the new addition is occupied by a cafeteria and locker rooms. The cafeteria is heated with wall mounted copper fin convectors while the locker rooms are heated with both wall mounted copper fin convectors and horizontal blowing unit heaters.

Each unit heater is equipped with its own thermostatic control located in a position representative of the area served by the heaters. A separate switch is provided to make it possible to operate the fan blowers during the summer and to shut off any particular heating unit during the winter.

Steam Supply

Steam for the heating of this addition is supplied by two low-pressure boilers located in a separate boiler room. These boilers generate steam at approximately 10 lb. pressure and are of the steel water-tube type, each having a capacity of about 225 hp. They are equipped with forced draft fans since the stack is ra-

An official Navy photograph showing two Vought-Sikorsky planes in flight.

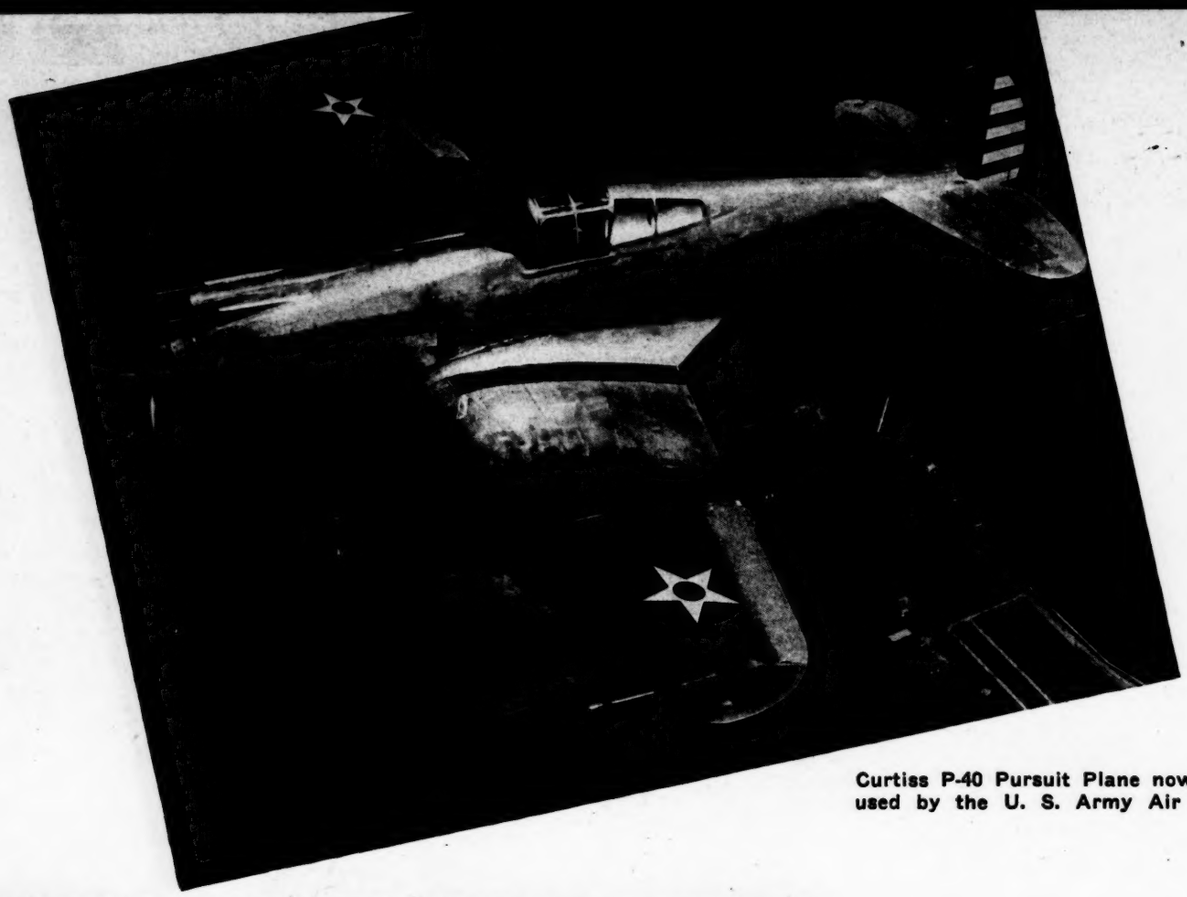


ther low. An oil storage capacity of about 10,000 gal. is provided by an outside partially buried tank. Steam heating coils in this tank keep the oil at approximately 130F to facilitate pumping. Before the oil enters the burners it is heated to 180F by a separate steam heating unit located in the boiler room.

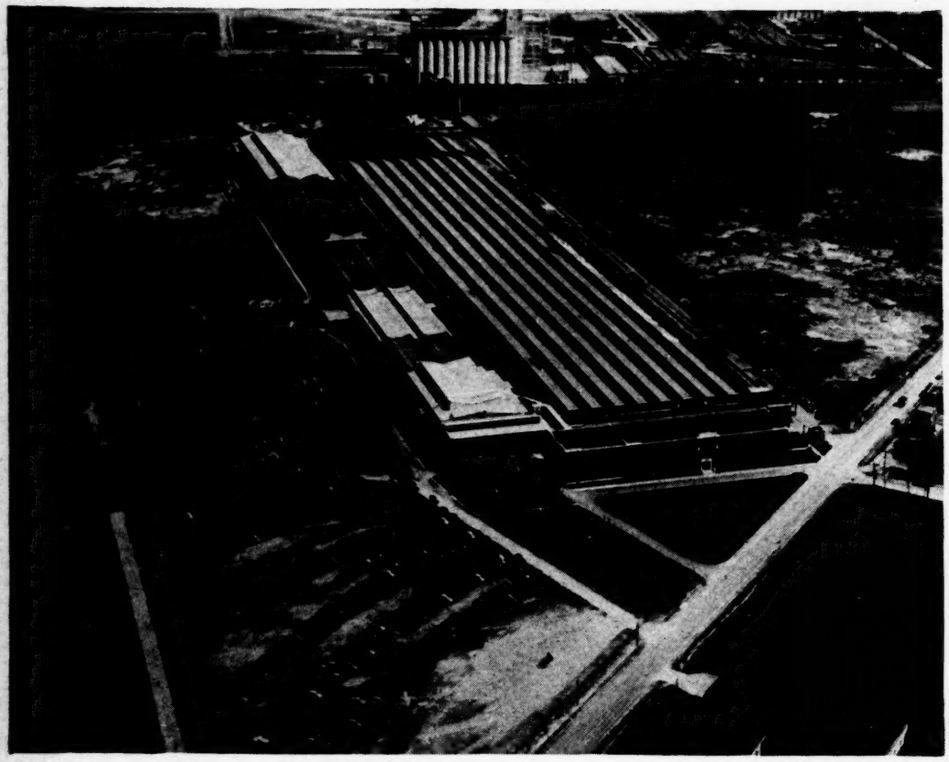
Exhaust Ventilation

Considerable exhaust ventilation apparatus is incorporated in this plant as there are many plating, heat treating, and paint spraying operations necessary. In general, each piece of equipment requiring exhaust ventilation has its own separate system. Of particular interest is the exhaust system used for exhausting fumes from the spray booths in which the large wing section and other parts are painted. One of these booths is shown on opposite page. Air is withdrawn from two opposite sides and the exhaust openings are so arranged that the air discharge is practically even over the entire wall area. In the ceiling of these paint discharge booths are large totally enclosed lights. One duct runs from each wall and discharges the contaminated air directly to the roof. Propeller fans driven by belts from motors mounted outside of the duct are provided in each of these ducts.

Final assembly area of plant which is heated by Trane blast heaters, under control of Minneapolis-Honeywell thermostats. Projection heaters are used in rest of new addition.



Curtiss P-40 Pursuit Plane now being used by the U. S. Army Air Corps.



The new plant of the Curtiss Aeroplane Division of Curtiss-Wright Corp., Buffalo, was designed by Albert Kahn Associated Architects and Engineers, Inc., of Detroit, in cooperation with the engineers of the Curtiss Aeroplane Division

Plant of the Curtiss Aeroplane Division, Curtiss-Wright Corp., Buffalo, N. Y. The experimental department is located in the near corner at the front left, while the new addition extends back of this the whole length of the old plant.

Water washed backs are provided in these shallow spray painting booths with the air exhausted by propeller fans, furnished by Binks, to outlets on the roof.

CURTISS-WRIGHT

AIR CONDITIONING FOR AIR DEFENSE

—Curtiss Aeroplane Division Makes Extensive Use of Unit Heaters and Exhaust Ventilation in New Plant

FOUNDED in 1910, with Glenn H. Curtiss as president, the original Curtiss Aeroplane Company made aviation history in the World War with such famous planes as the Curtiss "Jenny," the H and F Boats and such engines as the OX5, K6 and C12. In 1923 the company was reorganized and renamed. In 1936 the name of the organization was again changed, this time to the Curtiss Aeroplane Division of the Curtiss-Wright Corporation. Three buildings were added to the company's Buffalo plant in 1938; during 1939 it was decided to construct a separate addition where experimental work could be carried on with a greater degree of secrecy than formerly. To provide additional space for final assembly, a second building was completed late in 1939, completing a rectangle which gives the Curtiss plant a floor area of approximately three-quarters of a million square feet. This company is outstanding in military plane production and, in fact, produces nothing else.

Heating

Steam is generated at 125 to 150 lb. pressure in a central boiler plant, located at the extreme end of the company's property, which serves the whole plant. The pressure is reduced to 30 to 50 lbs., after which it is distributed to the points of usage which include a number of process applications as well as heating.

The final assembly, metal surfacing, foundry and experimental departments are heated by approximately 35 suspended unit heaters with revolving diffusers. These units, although mounted 25 feet above the floor at the ceiling, showed, under recent tests on a cold day, that there was only a 144F differential between the level 5 ft. from the floor and the ceiling. The revolving diffusers rotate at approximately one revolution per minute.

Ventilation

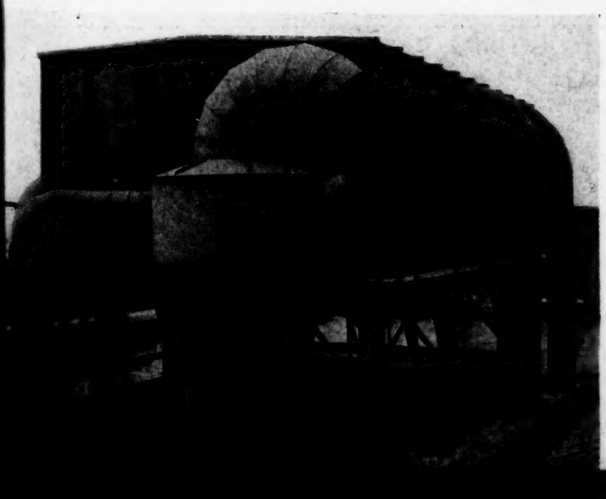
There are numerous different applications of ventilation in the old and new plants, including exhaust systems at the anodizing tanks, acid cleaning tanks, plating tanks, heat treating furnaces, in connection with sandblasting, at the spray painting booths and for exhausting wood shavings and wood dust in the pattern shop. In addition, there are smaller systems at metal grinders located in a number of different departments.

Anodizing is a process performed on certain aluminum alloy parts of the airplanes to render them anti-corrosive. The liquid which is used in this process is approximately a 10% solution of chromic acid which is exceedingly irritating to the membranes of the nose, throat and lungs. The three tanks in which this process is performed are 21 ft. long, about 3 ft. wide and 4 ft. deep. In order to exhaust the vapor from the chromic acid solution, rectangular ducts are run lengthwise at both of the long edges of the tank with slots approximately 2 in. wide and located about ½ in. above the surface of the liquid. These ducts are connected at one end to a header, which in turn is connected to a system of branches, all tied in together in one system.

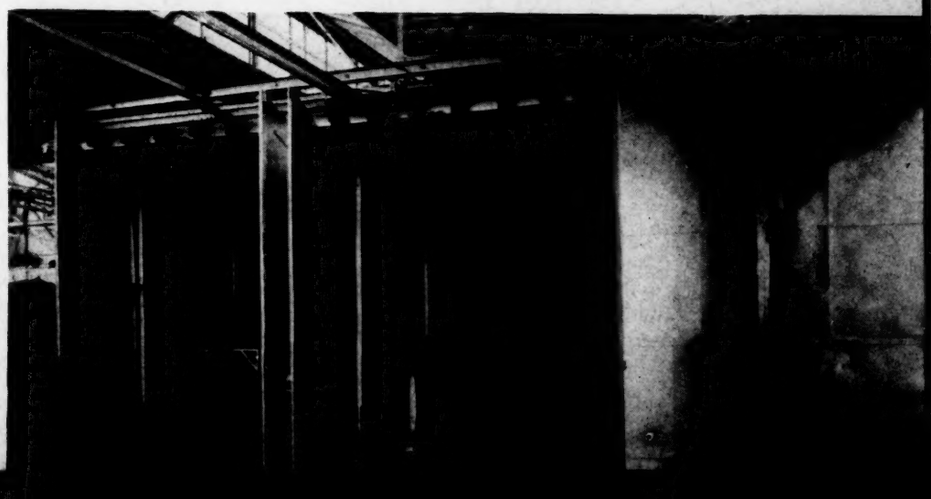
After anodizing, the parts are cleaned. This operation is performed in cleaning tanks of which there are about six pairs, each pair containing hot water in one tank and cold water in the other. The purpose of this operation is to remove from the part grease which would be detrimental to the electroplating action. The tanks are about 20 ft. long and about 3 x 4 ft. in plan, and since there are no dangerous fumes, it is not necessary to use the slot method of exhaust. Instead, hoods are placed some distance above the tank and extending over the whole area of the tank, all connected by elbows to a common duct served by one motor-driven blower.

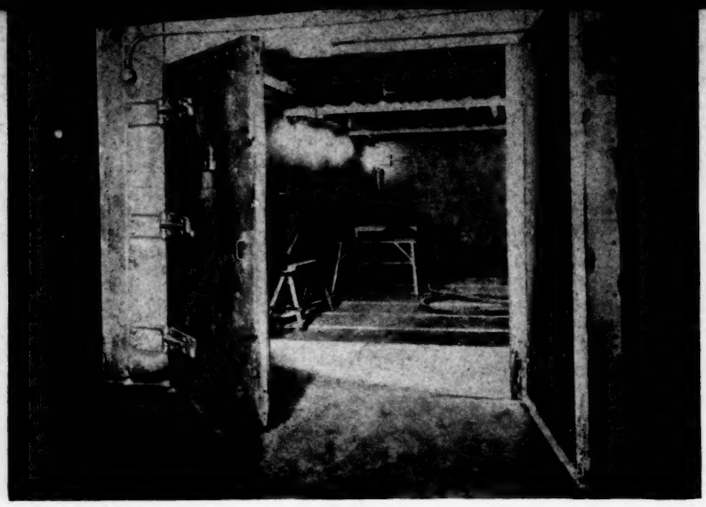
Cadmium plating is applied to certain steel parts as a corrosion resistant, while nickel plating is used on such parts as must resist wear and have a polished surface. Before nickel can be applied, however, the part must be plated with copper, so that for the three types of plating there are five tanks, three of which are for cadmium plating. Here, as with the cleaning tanks, the hood method is used, all connected to a com-

View on the roof of the Curtiss-Wright plant over the wood working department showing connections to the dust collecting equipment.



View of the drying oven in which air is recirculated at 160F. Twenty-five per cent air is heated by passage over Aerofin surfaces and filtered before entering.





Sandblasting room. Air enters through the ceiling, is drawn past the workers and into slots formed by the side walls, thence up into the ducts leading to the exhaust fan.

Ceiling mounted blower and branches of the exhaust system which serve to ventilate the pattern shop. A 15 hp. motor drives the blower.

mon system served by a 35 hp. motor-driven, centrifugal blower.

In some cases chromium plating has replaced nickel plating, especially where corrosion resistance is the principal objective. There is one chromium plating tank in the Curtiss plant with the slot type exhaust ducts extending lengthwise along the tank and connected to a 5 hp. motor-driven blower from which the exhaust is run to the roof.

Army specifications for planes call for a prime coating of a peculiar greenish yellow paint and it is necessary that all internal parts of Army planes must be primed with this paint. To perform this operation, the parts are dipped in the solution of zinc chromate contained in four shallow tanks, two of which are 15 ft. long and two 8 ft. long, all four tanks being approximately 1 ft. wide and 1 ft. deep. Here, too, the air is exhausted through slots along the side of the tanks and exhausted into one system connected to a 5 hp. centrifugal blower.

A 5 hp. exhaust system is also provided for a washing machine which is completely enclosed and in which parts are washed before painting. The solution, which is patented, is a dangerous one from a respiratory standpoint and, consequently, not only is the machine enclosed, but the fumes are drawn off through an exhaust system. In this machine baskets holding innumerable small parts are automatically dipped in three successive tanks.

In the older plant, forgings, stainless steel exhaust stacks, and motor mounts are sandblasted. This is performed in an enclosure 10 ft. wide and 28 ft. long and approximately 10 ft. high. This room is completely enclosed with a grilled ceiling open to the factory air. False side walls form a curtain which stops just short of the floor, outside of which is the main wall. This leaves an open space or chamber along both of the long walls, and the top of the chamber is connected to a duct which is connected to a 25 hp. motor-driven blower.

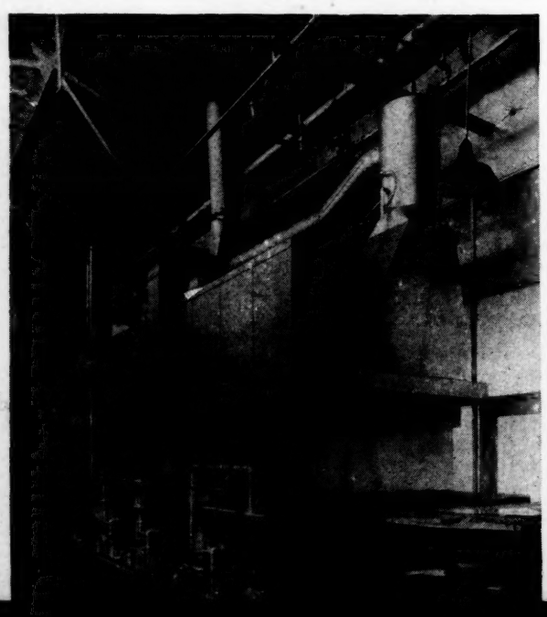
With this system air is drawn in through the grille work in the ceiling, past the part on which the operation is being performed, and the sand-laden air is swept towards the slots at the floor level, so that the dirty air is pulled away from the worker's mouth and nose, drawn up through the chambers along the sides, and thence outdoors.

Painting

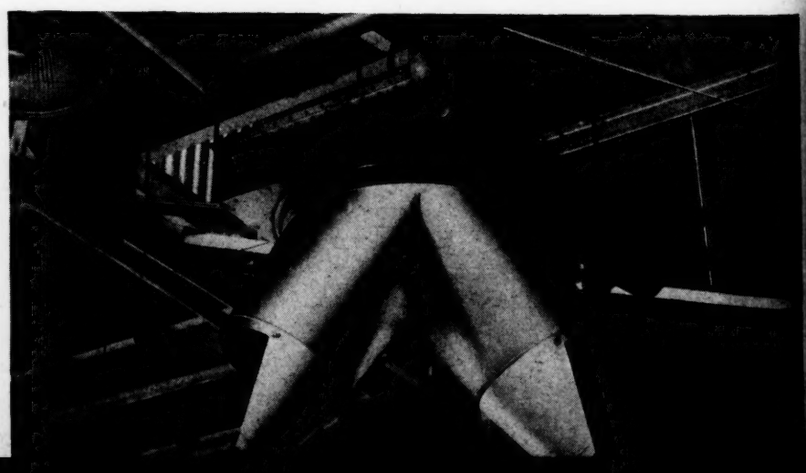
The paint department is located in a space approximately 100 x 245 ft. Included in this department is a shallow row of water-washed spray booths, as well as five tunnel type booths, ranging from 8 to 18 ft. wide.

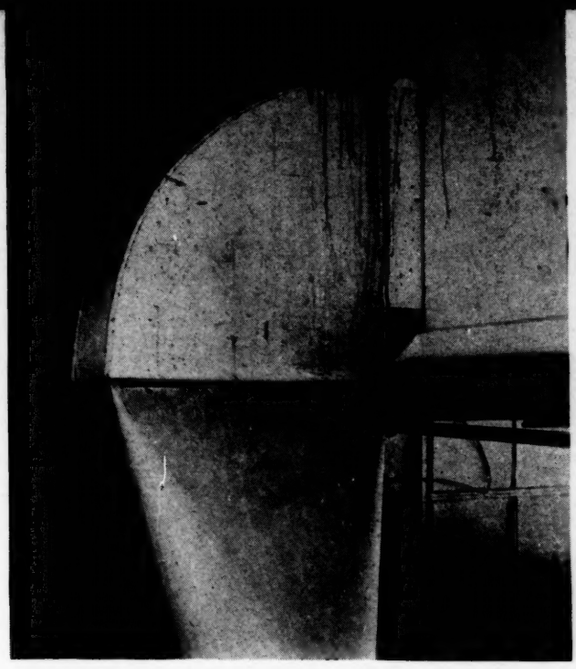
The shallow spray booth is 60 ft. long and has sliding partitions so that pieces as long as 18 ft. can be accommodated. The booths may be operated as single

The washing machine where small parts are automatically cleaned by passing through successive solutions. Fumes are exhausted through the system shown.



Clcseup of one of the Wing unit heaters whose revolving diffusers make one complete rotation per minute.





An exhaust slot extends lengthwise along the tank at the left which emits dangerous fumes. Note the connection of the tank exhaust duct to its riser.

The five Niagara floor type unit heaters which serve the paint department are shown along the left wall. Due to the large volume of air exhausted from this department it is necessary to introduce outside air through these units.

units with as many or as few in action as desired. A wall of water washes the back of the booths facing the operators; this water is charged with a special soap compound which causes the over spray to congeal like sponge rubber, after which it may be taken out of the water by a filtering system every twelve hours. Air is exhausted through the base of the water panel and eliminates the necessity of using paint masks by the operators.

A certain amount of the paint becomes such a fine powder that it settles to the bottom of the water in the booths, although much sediment is removed manually. This necessitates a change of fresh water and compound approximately every three months. Interesting statistics show that under the old system, a monthly cleaning by sixteen to eighteen men, working six to eight hours, was necessary to remove paint from booth floors and ventilation system. With the present equipment, one helper spends four to six hours a week and is able to keep the booths clean continuously. Air drawn through the water keeps the paint from spreading out into the room and the floor outside of the booth remains clean at all times.

The ventilation is provided by 42 in. propeller fans mounted in hoods as shown in the accompanying illustration and driven by explosion-proof motors.

Similar propeller fans of the same size are used in the spray tunnels, bringing the total in use in the paint department to ten.

Due to the large volume of air exhausted from this room, it is necessary to heat outside air for make-up and for this purpose five unit heaters of the floor type are located on the south side of the building, so that the low pressure on the north side spray booths causes warm air to flow across the room, thus assisting in the proper drying of the dope. A complete change of air is provided in the building every three minutes.

In the same department is a large drying oven kept at a temperature of 160F and insulated with spun glass. This oven is used for drying the paint on finished parts. The air is continuously recirculated in this oven except for 25% outside air which is first heated by passing over an extended heating surface and through glass filters.

Wood and Metal Exhaust

About twelve machines in the pattern shop, including a joiner, planer and a number of saws, are connected to a common exhaust system with a 15 hp. motor-driven blower and connected to a dust collector. In addition there are approximately six metal grinders in various other departments.

Thus, the Curtiss plant illustrates to a high degree the extent to which smoothly flowing production lines in industrial plants engaged in the defense program depend on the unspectacular but highly necessary heating and ventilating systems.

A view in the assembly department, with one of the unit heaters shown overhead.

Exhaust system, with hoods, for the water washing tanks in which parts are cleaned after anodizing.

CONSOLIDATED AIRCRAFT

Corporation, San Diego, is noted for development of flying boats, and recently turned out the world's largest amphibian plane. In addition to the four-engined bombers for the U.S. Navy (above) this company is also producing a bombardment plane for the United States Army Air Corps driven by four radial 1200 hp. engines. WILLIAM A. MALONEY, Consolidated plant engineer, here describes how the problems of heating southern California buildings differ from those in the east.

THE problem of supplying heat to an airplane factory in Southern California does not differ greatly from that of supplying heat to a manufacturing establishment of the same character in the Middle West or on the Atlantic Seaboard.

True, there is a considerable difference in design temperatures, but there is a corresponding, and offsetting, difference in the thermal conductivity characteristics of the construction materials used.

Along the northern Atlantic Seaboard and in the Middle Atlantic and Plains States, the common practice is to design for a differential of 0-70F or thereabouts, whereas, in California it is only necessary to design for a range of 35-70F. This difference in design temperatures does not necessarily indicate a large reduction in radiator surface requirements, for the reason that there is a considerable difference in the character of the available and employable building materials.

In the eastern section of the United States, the worst enemy of the heating engineer, when considering building materials, is the glass used in windows for the purpose of admitting daylight. For the balance of the building such materials as brick and concrete are used for basic walls and spandrels, and roofs are usually wood or concrete decks covered with felt and asphalt compound roofing.

In sunny California, the available choice of materials changes considerably. The most popular and widely used material for wall and roof construction in industrial buildings is galvanized corrugated iron.

Although Southern California is looked upon by most of us as being a land possessed of a glorious sub-tropic climate, the fact still remains that the nights are quite cold, the temperature dropping to 35F or 40F after 8 p.m. in the winter months (November-April) and even in the summer months often going as low as 55F.

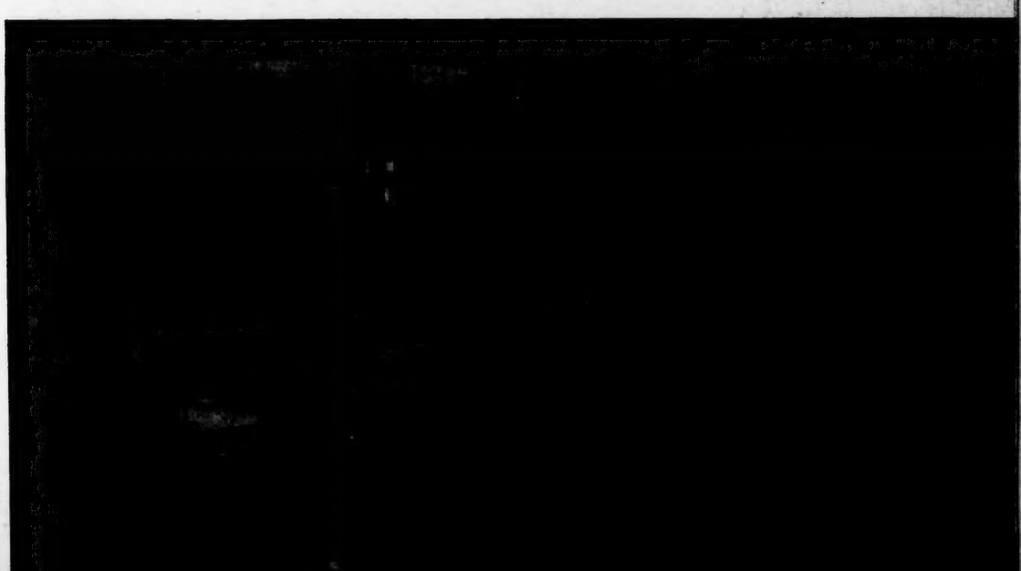
The outstanding characteristics of most aircraft manufacturing buildings are, first, the necessity for unobstructed clear height above the floor; second, the insistence on vast, unobstructed clear areas on the manufacturing and assembly floors. The first condition imposes on the designing engineer the necessity of keeping all supply and return lines above the bottom chord of the roof trusses, in order that the full height between the floor and the bottom chord line may be advantageously employed in handling large airplane fuselages and flying boat hulls. The second consideration compels the engineer to design carefully for uniform distribution and circulation of the warm air discharged from unit heaters in order to avoid the phenomenon of Cold 70. A third consideration, not previously mentioned, is the tendency to keep open the large hangar type doors which usually enclose two or three sides of modern aircraft manufacturing buildings. These doors must be kept open for the reason that "if we don't take a ship out Monday morning, we will surely take one out Wednesday afternoon."

In the 1939-40 expansion program at Consolidated there have been numerous additions to existing buildings, in which the boiler plant and piping systems were designed to allow for additions and expansions. Therefore, this discussion will not consider these additions, but will deal entirely with those separate new buildings served from a new, centrally-located boiler house.

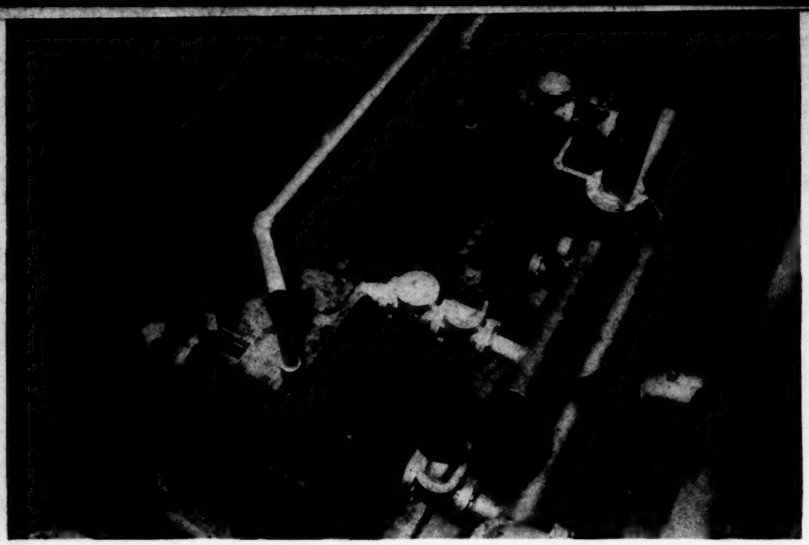
The largest unit in the present program is the Final Assembly Building, measuring 360 ft. x 720 ft., con-

Final assembly building, general view of west wall, showing steam and return mains above bottom chord line of trusses.

Final assembly building. Steam and return mains, gas and water lines are seen rising from supply tunnel.



Interior of assembly building showing a large group of U. S. Navy planes under construction.



A view in the boiler house just before completion showing the Chicago vacuum pumps and return header installation. Warren Webster valves and traps were used.

A view in the boiler house during the construction of the building showing the four Fitzgibbons boilers in process of installation.

taining with stockroom mezzanines, a total of 281,600 sq. ft. of usable floor area. In this building it was necessary to keep all heating and return mains, as well as other necessary services, above the bottom chord line of the roof trusses, in order not to interfere with the movement of travelling cranes required in the building. As the distance from the bottom chord to the floor was 36 ft., it was necessary to use high velocity, high output unit heaters located above the bottom chord line and discharging downward to the floor. The same considerations of clearance precluded the possibility of extending steam and return mains, and obtaining the required pitch, inside the building. It was, therefore, necessary to run these mains above the bottom chord line along the west exterior wall of the building, sufficiently high to permit the taking off of laterals in the various sawtooth bays, bringing the returned condensate back to the return main well above the bottom chord line.

The next largest building in point of volume, but not in area, is the Final Finish Building, to which finished airplanes, after engine and flying tests, are returned for final *touch-up* of exterior painting. This building is 120 ft. wide and 240 ft. long, with a clear height to bottom chord of truss of 36 ft., and is heated by a conventional fan system. Sufficient filtered, heated, outside air is introduced to the building to provide 7½ air changes per hour. For present operations, this volume of air is considered sufficient, but the fan rooms, of which there are two, both located above the bottom chord line, are designed and arranged to permit the addition of sufficient equipment to permit of providing 15 air changes per hour, should the building ever be converted to use for general spray painting operations. No provision for exhausting air is made at present, leakage through door cracks, steel sash mullions, and corrugated iron laps being deemed sufficient. The final plan (15 air changes per hour) includes provision for a water washed exhaust system to separate all pigment and solvents from the exhausted air.

A view looking into the roof of the final assembly building showing one of the Buffalo Forge unit heaters. Herman Nelson DeLuxe unit heaters and Young Radiator concealed radiation were used.

The remaining major building, known as the *shed* is 30 ft. wide, 1000 ft. long, of lean-to construction, with an average height of 25 ft., and is heated by conventional, low discharge velocity unit heaters.

The total load in these three buildings is 158,500 sq. ft. E.D.R. and is supplied by a battery of four welded steel fire-tube boilers in a central boiler house, each of 42,500 sq. ft. capacity. These boilers are fired with radiant type burners, using 1200 B.t.u. natural gas, sufficient to develop 200% of rating at an overall efficiency of 77%. As the boiler house is located on the edge of Lindbergh Field, San Diego's airport, it was necessary to employ induced draft to keep the stack height below the safe gliding angle for entering airplanes. Gas and primary air supply are controlled by pressure operated valves and louvres, and the induced draft fans are controlled by stack temperature relays.

Temperature control in the manufacturing and assembly buildings is accomplished by means of local thermostats controlling the fan motors. In the Final Finish Building a pneumatically-operated by-pass damper system is used.

In the boiler plant, the supply and return headers, as well as the vacuum pump headers, are so arranged that the capacity can be quadrupled without changes to the piping system, and with but minor changes to the building structure and arrangement.

Navy Explains Its Position on Sub-Contract Awards

AT least 100,000 dwelling units are needed to ease the serious defense housing shortage, it was reported in Washington late in August. The disclosure followed President Roosevelt's intervention in an effort to end the bureaucratic and legislative battle that has hindered the building of housing facilities around the expanding Navy yard facilities, aviation factories and other defense industries.

The President is reported to have ordered his housing lieutenants to end their internecine war and attack the problem that is threatening to bog down the defense program.

Late in July Charles F. Palmer, an Atlanta business man long active in the housing field, was appointed as co-ordinator with the National Defense Council.

On July 20, in a statement to the press, Mr. Palmer indicated that sufficient housing must be provided, through private capital if possible but if not by public money. However, on August 27 he requested Congress for $150,000,000 to start a defense housing program under the jurisdiction of the Federal Works Agency. It was also reported that even government officials in the Agency were surprised by this action.

Senator Robert Wagner of New York, creator of the United States Housing Authority, who felt that USHA would be left out in the cold by the National Defense Council, conferred with the President on August 27 and subsequently announced that he would offer a one hundred million dollar emergency housing amendment to the pending five billion dollar defense appropriation bill. The amendment, Senator Wagner explained, would give the President authority to decide whether the facilities of private enterprise, the Army and the Navy, or government housing agencies, would be used.

He is reported as expressing the belief that USHA and other organizations experienced in housing should have a part in the program. The President voiced the same line of reasoning at his press conference the same day.

Mr. Palmer, who is attached to the office of the Secretary to the Advisory Commission, is responsible for the co-ordinating of activities of federal agencies that will be concerned with defense housing at the present time. He will determine just what agencies, public or private, will be involved in defense housing construction. Standards of construction of this housing will include those factors which affect costs and those factors which affect livability, community facilities, utilities, etc. It will be necessary for Mr. Palmer to cooperate with other governmental agencies where labor and materials are concerned.

Army and Navy Construction

If as in reply to criticism that the defense program was lagging, contracts on the Army's billion dollar construction program began to move the middle of August. At that time announcement was made of construction of a twenty million dollar military tank plant, a second twenty-five million dollar smokeless powder plant, a six-million dollar general depot and numerous other buildings for the Army. Consequently, the War Department's program is at last beginning to catch up with the Navy and Army Air Corps construction programs.

The military tank plant will be built and operated by the Chrysler Corp and will cover about 800,000 sq. ft. on a site in the Detroit area. Plans call for the employment of between 4000 and 5000 men for initial production.

The new powder plant will be built and operated by the Hercules Powder Company on a 2500-acre tract in Virginia. Five thousand men will be employed on the construction, beginning almost immediately.

Award of contracts covering construction of temporary housing at Fort Knox and Camp Jackson was made in the middle of August. Structures to be erected are mobilization type two-story buildings designed to house 60 men each. Camp Jackson buildings will be served by a central steam heating plant while those at Fort Knox will be provided with forced warm air.

Also announced in August were contracts for nearly six million dollars of additions to the Edgewood Arsenal of the Chemical Warfare Service and to the Aberdeen, Md., proving grounds.

Contract Situation

Last month on these pages the general situation regarding the cost-plus-fixed-fee contracts with which heating and ventilating, plumbing and other sub-contractors, as well as consulting engineers and architects, are very much concerned, was described. This position has not changed, according to an interview with Colonel O. R. McGuire, who is acting as counsel for the following organizations: National Electrical Contractors Association; Heating, Piping and Air Conditioning Contractors National Association; Mason Contractors National Association; and National Association of Master Plumbers.

The interview with Colonel McGuire follows:

"The position of sub-contractors with relation to Army and Navy construction contracts has not changed during the last month and there is no indication that any is contemplated.

"As was the case on August 1, 1940, the few contracts let thus far by the Army under the cost-plus-fixed-fee plan have definitely contemplated division of all work under practices commonly followed by general contractors and sub-contractors.

"Provision for this has been made by the use of a general contract form with appended or supplementary

forms to be made out by sub-contractors. Thus at the time the contract is negotiated, the Army and the general contractor know in advance how much of each contract is to be done by the general contractor and how much by sub-contractors. The fees to be paid to sub-contractors thus become a part of the primary contract, and the general contractor's fee is adjusted to remain within the statutory limit and to cover fees charged by sub-contractors.

"Although Army contracts make provision for sub-contractors, there is nothing in the set-up requiring that they be used. Whether the general contractor accepts the entire assignment or sub-contracts the specialty operation depends upon the type of the general contractor's organization and whether or not he is equipped to do the entire job.

"The Army's records on contractors is minutely detailed. Studies resulting in a given contractor being called in for consultation reveal in advance about what proportion of the work the general contractor is equipped to do himself and what quantity he will probably prefer to turn over to sub-contractors.

"With regard to the Navy, the situation is no so acceptable to sub-contractors, who would frankly prefer to see provisions for the sub-contractors written into the record by means of sub-contractors' forms as specific as those of the Army.

"For the present the Navy has issued a statement of policy (late in July) saying it is concerned only with facilitating the work, eliminating delays, and getting the work done with the least possible expense. This is the policy we all favor, but as in all subjects, honest differences of opinion arise.

"Whereas the sub-contractors, through their organizations, contend that the precedent of normal business procedure proves that general contractors almost invariably employ sub-contractors for certain portions of construction projects let at fixed prices, the Navy seems content to let the general contractor on a cost-plus-fixed-fee basis decide for himself which plan to follow.

"Up to this point there seems to be little variance between the objectives of Navy purchasing officers and the viewpoints of sub-contractors. Both have the same objectives of desiring speed with economy; sub-contractors contend general contractors adopt the sub-contract plan when their own pocketbooks are involved, and the Navy infers that if such is the case, general contractors will, if they desire, employ sub-contractors on Navy assignments.

"Here, however, sub-contractors take the position that Old Man Human Nature enters the picture and that since 'cost-plus' is a relative term involving variables in which Uncle Sam may not prove as exacting a bargainer as the individual purchaser might be, the general contractor may (and can) indulge his inclination to save supervisory fees and expand his own organization by performing mechanical services he has previously found profitable to purchase through outside experts.

"To what extent such a possible tendency might progress is not known. To date there are examples that sub-contractors have been overlooked in setting up Navy projects. This fact, apparent as recent as the letting of a contract during July to a general contractor for a project in the South, lends credence to the sub-contractors' position that the movement could become general—with resulting loss to sub-contractors and eventually, unnecessary expense to contracting parties.

"While no official action is under way or immediately contemplated by parties to the controversy, it seems to me that effecting a better understanding between the parties would eventually result in adjustments. Navy officials have issued a frank and fair statement of their intention to have the construction work completed as quickly and economically as possible. In the same spirit of fairness I feel certain they will give consideration—even if initially on the premise that 'where there is smoke there must be fire'—to the expressed position of the interested sub-contractors."

Admiral Moreell's Statement

The attitude of the Navy is more fully explained in the following letter from Admiral B. Moreell, Chief of the Bureau of Yards and Docks, Navy Department:

Navy Department
Bureau of Yards and Docks
Washington, D. C.
August 30, 1940.

Editor, HEATING & VENTILATING:

I have your letter of August 28, 1940, wherein you request a statement from me to clarify the Bureau's policy relative to subcontracts on fee contracts.

I refer to the article in HEATING & VENTILATING for August, 1940, wherein (on page 15) is quoted the Bureau's policy to the effect that it is the Bureau's intention that every advantage shall be taken of the availability of skilled specialists for subcontract work, and that those specialties which are usually subcontracted by the general contractor may be subcontracted on the fee contracts.

The Bureau has followed this policy since the inception of its fee contracts in August, 1939. We have now had more than a year of experience with these fee contracts and they have operated to our entire satisfaction.

In the questions accompanying your letter, you refer to forms of subcontracts which have been developed by the War Department. Undoubtedly such a form is believed by the War Department to be desirable to meet their administrative needs. The procedure used by the Navy Department, wherein each subcontract is made in the light of the special requirements for the job, has been proved eminently satisfactory in actual experience and we see no reason to change.

Referring again to the article mentioned above, I note the following statement on page 15:

"Beginning early this year, however, the Navy Department began to let the contracts under a cost-plus-fixed-fee basis whereby the basic drawings are prepared by private architects and engineers, and arrangements made with the general contractor to prepare working drawings, and to conctruct the building, including work traditionally handled by subcontracting, all on a cost basis plus a negotiated fee. The fee represents the general contractor's profit."

That statement is not correct. To date, all drawings and specifications for fee contracts have been prepared

GENERAL INFORMATION

- Date of survey
- Name of prospect
- Location of job
- Owner

- Who must approve job
- New building or alteration
- Length of lease
- Does owner agree to installation

- Must job conform to local code
- Must job conform to Underwriters' code
- Must job conform to any state code
- Are other trades union or non-union

SPACE CONDITIONS

- To what use is space put
- Is smoking allowed
- Any unusual odors generated
- Loose or tight building construction

- Floor area
- Ceiling height
- Cubical contents
- Area of doors and windows to be open

- What equipment is located
- Are hoods effective
- Are other hoods desirable
- Any unusual dust condition

COOLING AND HEATING LOAD QUANTITIES

- Number of occupants
- Degree of activity of occupants
- Total light wattage
- Light wattage on sunny day
- Are awnings and blinds on exposed windows
- Are blinds of venetian type
- Is load such as to require zoning

- Horsepower of motors
- Heat generated by gas-burners
- Any other heat generating equipment
- Product load, if any
- Time phases on component loads
- Period spaces are occupied
- Areas with concentrated loads

- Moisture load
- Exposed window and wall area
- Compass rose
- Winter conditions to be maintained
- Summer conditions to be maintained
- Outside winter design conditions
- Outside summer design conditions

WATER FACILITIES

- Size of city main connection
- Location of possible tap-in
- City water temperature
- City water pressure
- Size of present water meter
- Is constant quantity flow assured

- Is well water available
- Well water flow, quantity
- Well water temperature
- Well water pressure
- Well water location
- Corrosion properties of well water

- Length of water line to condenser
- Length of water line to spray nozzles
- Must water lines to condenser be insulated
- Cost of water
- Hardness of water
- Head available using house tank

STEAM SUPPLY FACILITIES

- Location of steam supply
- Kind of steam supply available
- Steam pressure available
- Is there constant supply year-round
- Boiler location
- Boiler capacity
- Type of existing heating system

- Excess capacity of boiler
- Boiler operating pressure
- Boiler water level, operating
- Head available to drain heating coil
- How is boiler fired
- Location of controlling thermostat
- Type of heating system control

- Is return trap or condensate pump needed
- Distance, steam source to heating coil
- Length condensate return run to boiler
- Location steam main nearest heat coil

HOT WATER HEATING SUPPLY

- Location of boiler
- Size of boiler
- Excess boiler capacity

- Location of storage tank
- Capacity of storage tank
- Possible location of H.W. circ. pump

- Distance, tank to heating coil
- Distance, heating coil to tank
- Temperature of hot water

ELECTRIC POWER FACILITIES

- Electric power voltage
- Electric power phase
- Electric power cycles

- Location of power panel
- Horsepower connected at present
- Horsepower to be added

- Permissible starting current inrush
- Electric power cost
- Name of utility company

REFRIGERATION FACILITIES

- Name of compressor manufacturer
- Model number of compressor
- Operating condensing pressure

- Operating suction pressure
- Refrigerant used
- Is 15 lb. air available continuously

- Quantity flow of chilled water or brine available if system is indirect
- Excess refrigeration available

DRAIN AND SEWER FACILITIES

- Size of present sewer
- Location of sewer
- Condition of present sewer
- Is sewer vented

- Size of present slop sink*
- Location of slop sink
- Condition of slop sink
- Head for draining condensate pan

- Distance, condenser to slop sink
- Distance, condensate drip line to sink
- Is condensate pump necessary
- Must condensate drip line be insulated

*A slop sink, properly vented and provided with a supply of water to maintain water seal in trap is required. Sinks used for food washing or provided with a plug receptacle and strainer are not acceptable.

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H. & V.'s REFERENCE DATA—181

CHECK LIST FOR AIR CONDITIONING SURVEYS

(CONTINUED)

AIR DISTRIBUTION

- Exhaust duct sizes
- Exhaust fan data
- Exhaust fan motor data
- Exhaust fan foundation data
- Exhaust fan motor foundation
- Air quantity, exhaust system
- Exhaust grille sizes
- Supply duct sizes
- Supply fan data
- Supply fan motor data
- Supply fan foundation data
- Supply fan motor foundation data
- Air quantity, supply system
- Supply system grille sizes
- Grille locations

LOCATING EQUIPMENT

- Does available space for ducts indicate a central duct system or room units
- Passage space for delivery of equipment
- Check for possible changes to partitions between survey and installation
- Noise considerations
- Is elevator available
- Check loading and size of elevator
- Is rigging or special handling needed
- Is spring loaded compressor foundation needed due to upper floor mounting
- Check outside window area with fire code
- Is water-proof equipment floor necessary
- Visualize equipment set in place and check location for accessibility
- Check the heating of the proposed equipment room in winter to prevent the freeze-up of condenser if water cooled

DUCT SYSTEM

- Noise considerations
- Locate fresh air intake so as to prevent contamination of air supply
- Locate exhaust to atmosphere and place on side of building opposite to that on which air intake is located
- What duct work is to be insulated
- Locate fire walls and partitions
- Possible location of control equipment

MISCELLANEOUS CONSIDERATIONS

- Bonded roof to be cut
- Economizer to run year round
- Working hours—straight time in what spaces, overtime in what spaces
- Is job location such that treatment of air washer water is needed
- Are other washers operating nearby
- If so, of what material are they
- Length of service of nearby washers
- Present condition of nearby washers
- Do nearby washers use treated water
- Bad corrosion experience with nearby plants

UNDER THE CONTRACT WHO WILL PERFORM FOLLOWING

- Cutting and patching
- Install water meter
- Electric wiring
- Clean existing ducts
- Finish painting of equipment
- Remove or relocate present wiring
- Remove existing electric fixtures
- Remove existing piping
- Install and connect drain mains
- Make water connections
- Make refrigerating connections
- Make steam connections
- Insulate steam piping
- Insulate ducts
- Insulate cold water mains
- Insulate hot water mains
- Install access openings
- Install grilles and plaques
- Lay foundations
- Carpenter work
- Masonry work
- Excavating
- Plastering
- Structural supports for equipment
- Waterproof floors
- Build equipment room partitions
- Cut holes for pipes, ducts, grilles

In making air conditioning surveys, it is important that care be taken so that no items are left out. The check list which appears on this data sheet furnishes a systematic method of checking all of the important information needed in making an air conditioning survey.

This list was prepared by John D. Constance, has been in use for some time and is believed to have all of the important items listed on it.

Other HEATING & VENTILATING Reference Data Sheets which will be of interest to air conditioning engineers are sheets 153-154, which present a check list for air conditioning drawings. This list covers all of the important items which should be included on air conditioning drawings.

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H. & V.'s REFERENCE DATA—182

by architects and engineers, either in the Government's forces or in private practice. Those drawings and specifications which have been prepared by the contractors are the ones which are, in usual practice under lump sum bidding, prepared by the contractors—namely, specifications for purchase orders and such sketches as are needed to supplement the contract drawings. There may be one or two small exceptions to this statement, where drawings have been prepared by the contractors in the interests of speed, but these instances are so minor as to be completely negligible.

I take exception, also, to the statement that the contracts provided for all work "including work traditionally handled by subcontracting." With the exception of the Western Pacific work, where subcontracts were impracticable on account of certain complicated conditions of transportation of men and materials, housing, recreation, subsistence, etc., we have approved subcontracts on all other contracts.

The fact that we have done a great deal of work with outside engineers and architects is indicated by the fact that since June 26, 1939, we have made more than 65 contracts with outside engineers and architects for which the total value of the gross fees is approximately $3,500,000. This total does not represent the value of the construction work, but the actual payments to engineers and architects.

In this connection I believe it pertinent to state that, prior to the Act of April 25, 1939, the Navy had no authority to engage outside engineers and architects except during the period of the World War. The Act of April 25, 1939, was proposed by the Navy Department at my instance, and the hearings on the Bill will indicate clearly that I have consistently opposed the building up of huge Governmental organizations of engineers and architects, and have consistently advocated the full utilization of the many splendid private engineering and architectural organizations which should be left in the hands of private management for the benefit not only of government but of industry.

It is pertinent, also, to state that after the Act referred to above was passed by the Congress, the War Department obtained similar authority.

Therefore, these two great Departments of the Government, which are now so greatly in need of every available productive source that the country affords, have access to the great engineering and architectural organizations of the country without having to resort to the destructive disorganization of those organizations by enrolling the personnel into the Government Departments.

With respect to the last paragraph on page 15 of the article referred to above, wherein it is stated that "... one of the reasons for the adoption of this system of handling building contracts by the Navy Department was to simplify procedure in that, by this method, one firm is responsible for the whole project," I invite your attention to the fact that the primary objective of the Navy Department in negotiating contracts for construction work is to accomplish the work with "certainty, speed, and economy." All of our contractors are told this, and they fully understand it. Any procedure which contributes to this objective will be adopted by the Navy, and since the Naval officials are and must continue to be responsible to the country for the results obtained, the decision as to whether or not a specific procedure contributes to the accomplishment of this objective must rest with the Navy Department.

The foregoing does not imply that we do not welcome constructive criticism, but criticism which is designed to throw doubt on the honesty and/or competence of public officials and their subordinates should, in all fairness, be made only when the critic is prepared to make his charges openly and to substantiate them.

Thus, statements attributed to "one important architect and a consulting engineer here in New York", mentioned in [your] letter, are most unfair because there are no data substantiating the statement. The only answer that can be made to such a categorical statement is that it is untrue.

A great deal of misunderstanding has arisen in this matter of subcontracts because of the misconception that where a subcontract is made the subcontractor is paid a fee. This is not the case. If the subcontract is a lump sum contract, then the profit of the subcontractor is in the lump sum and is not stated separately. If the subcontract contemplates that the actual cost of labor and material will be paid a lump sum as compensation for their services, the lump sum includes the subcontractor's profit but it is not stated separately, and no other lump sum is stated as a fee or as the subcontractor's profit.

There is no essential difference in the matter of subcontracting between a contract based on competitive bidding and the cost-plus-a-fixed-fee contracts. In either case the general contractor makes or recommends subcontracts as required to get the best results. The practice under the cost-plus-a-fixed-fee contracts is more favorable to subcontractors if the subcontract contemplates work being done on a cost basis because the subcontractor is sure of some profit, whereas if he makes a lump sum bid there may or may not turn out to be some profit.

The general contractor does not divide his fee with the subcontractor, for the reason that no fee is paid to the subcontractor. The fee of the general contractor may be reduced if the scope of the work which he does under the contract is materially changed from the scope of the work as contemplated when the amount of his fee was determined. How much profit a subcontractor has in his contract depends entirely upon the lump sum which is paid him as compensation for the services of his organization, or, if his subcontract is on a lump sum basis, how much profit is in his lump sum bid. The amount to be paid a subcontractor, if his contract is on a cost basis, is a matter to be determined by negotiation and agreement.

I hope that the foregoing will serve to clear up this matter which, in my opinion, has raised more controversial discussion than is warranted by the actual conditions.

Sincerely yours,

B. Moreell

Rear Admiral (CEC), U.S.N.

EDITORIALS

Effective September 1, Clifford Strock, associate editor for the past twelve years, becomes editor of HEATING & VENTILATING. Joseph F. Kern, Jr., assistant editor, becomes associate editor. C. H. B. Hotchkiss has resigned as editor to become vice-president and director of Ameresco, Inc., export representatives for heating, ventilating and air conditioning equipment.

Prior to joining HEATING & VENTILATING, Mr. Strock was with the International Heater Company and the Pennsylvania Railroad. He is a graduate of Purdue University, with B.S. and M.E. degrees. Mr. Kern, a graduate engineer of Brooklyn Polytechnic Institute, was with the Philross Sheet Metal Works and Erickson Equipment Co. Both are licensed professional engineers and members of the ASHVE and ASRE.

Mr. Hotchkiss will continue to be actively connected with HEATING & VENTILATING in the capacity of contributing editor.

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Industrial Ventilation

To many it must have seemed apparent about a decade ago that ventilating would eventually be a comparatively minor subdivision of the newer and better publicized art of air conditioning. Files of technical magazines and societies of that period seem to bear this out.

What seemed obvious then, it is now realized, was an entirely false impression. Probably never before has there been more activity in straight ventilating work, relative to general business activity, than there is now. Oddly enough, this has been brought about by the increasing demand for better atmospheric conditions in industrial plants, the very sphere in which air conditioning first made its influence felt. Much of this revival of interest in the ventilation is probably due to the splendid work done by the industrial hygiene departments of the various industrial states. In the activities of these departments, too, a reversal of trend is becoming apparent. In the early days of these bureaus paint fumes were one of the principal industrial hazards; later, the rising concern over silicosis resulted in considerable attention to ventilating of industrial plants where air-borne dust was a problem. At the present time, indications are that fume removal is again tending to increase in prominence.

Reasons for this are not hard to find. In the field of plastics alone hundreds of new chemicals have been added to the list of useful materials. Each new compound brings with it the question of its hazard. Many are harmless; many are known to be dangerous to the health of workmen who breathe their fumes; many more are too recent to have been thoroughly judged from the standpoint of hazard. Added to this, electroplating—chromium, tin, nickel, copper, cadmium—is a growing art with, in many cases associated health hazards. Further, the wide adoption of spray painting has increased the fume hazard as compared with the brush method.

No matter how hazardous the fume may be, however, it can probably be handled safely if adequate ventilation is provided. The engineer can do this. But first he must know what to provide and what the limits of hazard are.

To study the effects of an industrial hazard on the worker and eventually to set the limits for the ventilating engineer is the concern of the industrial hygienist. His activities have not only a wide scope, but often long years must pass after discovery before he can be certain of the hazard involved in a new compound. Technical skill, patience, and sympathy with and an understanding of the problem are essential.

The industrial hygienist is exploring new territory. Ventilating engineers on industrial projects have a common field of interest with him. He is the source to look for on allowable concentrations of dusts and fumes too recent to be tabulated in handbooks. He not only is helping in this respect; he is creating new markets for ventilation. These new markets mean growing business for ventilating engineers and contractors.

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Radiant Heating

Interest in the subject of radiant heating has been slowly but nevertheless steadily growing over the past several years. Radiant heating is talked about by some with intense enthusiasm, by others with some skepticism, and by the majority with at least a healthy interest.

At the present time there are probably more actual installations of radiant heating in this country than is commonly believed. While the greater number are in residences, there are offices, industrial buildings, and perhaps two or three other classifications included in the building types where radiant heating has been installed.

Assuming that radiant heating may become much more of a factor in the future than it is at the present, no one can tell just what form it may take. It would seem that radiant heating will appear in varied forms so that practically all branches of the heating industries will be interested in promoting it. It may take the form of hot water or steam piping in the walls, floors, or ceilings; it may consist of numerous warm air ducts along the walls connected to a warm air plant; or it may be obtained by numerous convector-heated spaces between the studding.

At any rate enough work is going along on all of these lines to indicate that if and when radiant heating does become popular it will not be a monopoly of any single company or group.

ABSTRACTS of Current Papers, Books and Pamphlets

Moisture Content of Textile Fibers

A report of an investigation to determine the moisture contents of 10 kinds of textile fibers in the form of specially prepared yarns when the fibers were in equilibrium with air for a series of relative humidities and temperatures. Data were obtained for both "desorption" and "adsorption," the yarns being brought to equilibrium from a wet condition and a dry condition, respectively. The fibers studied were raw cotton, "purified" cotton, mercerized cotton, clothing wool, carpet wool, viscose rayon, cuprammonium rayon, raw silk, degummed silk, and cellulose acetate. The temperatures ranged from 96F to 302F, and the relative humidities ranged from 5 to 90 per cent for temperatures below 212F and up to the maximum obtainable at atmospheric pressure above 212F.

The results are given in the form of graphs showing moisture content against relative humidity and also in the form of graphs in which the logarithms of the moisture contents at given relative humidities are plotted against the reciprocals of the corresponding absolute temperatures. The last show straightline relationships with changes in the slopes of the lines between 200F and 220F.

[*"Moisture Relations of Textile Fibers at Elevated Temperatures," by James G. Wiegerink. Research Paper RP1304, National Bureau of Standards. 20 pages. Paper for sale by the Superintendent of Documents, Washington, D. C. Price, 5c.*]

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Summer Air Conditioning

To test the value of a new type of silica gel dehumidifier in residential summer air conditioning, the Washington Gas Light Company installed such a unit in a six-room residence in Maryland and operated the job for one hot summer month under technical observation. Cost data are presented in this report to show that the estimated season operating costs would amount to $127.00—roughly 53% for gas, 35% for water, and 12% for electricity. The installation was engineered to maintain 80F and 45% relative humidity; to utilize existing duct work and registers serving gas fired winter air conditioning unit, and to utilize for air circulation the fan in the winter air conditioning. In addition to a complete description of the residence, installation, test procedure and results, the report offers nine suggestions for further improving the equipment in its application to residence air conditioning.

[*"Test of a Gas-Fired Summer Air Conditioning System, using Dehumidification with Reevaporative Cooling." Published as Interim Bulletin No. 1-AC of the Joint Committee on Summer Air Conditioning of the Industrial Gas and Commercial Section, American Gas Association. 420 Lexington Ave., New York, N. Y. Paper cover; 5¾ x 8 in.; 16 pages. Price, 10 cents.*]

BRIEF REVIEWS

SUN HEAT. A reprint of the three articles on estimating the flow of heat through sunlit walls and roofs which appeared in HEATING & VENTILATING in March, April and May, 1940. [*"Estimating the Flow of Heat Through Sunlit Walls and Roofs," by Prof. C. O. Mackey and L. T. Wright, Jr. Reprint No. 9. Published by the Engineering Experiment Station, College of Engineering, Cornell University, Ithaca, N. Y. Paper cover; 16 pages; 8½ x 11 in. Available on request.*]

ATTIC FANS. A bulletin for the use of architects, builders, attic fan dealers, and home owners who are interested in attic fan installation for summer comfort. Its scope is limited primarily to residential applications which it covers quite comprehensively from an explanation of the function of an attic fan installation through a discussion of costs, fan selection, installation methods, window fans, and operation methods. [*"The Installation and Use of Attic Fans," by W. H. Badgett. Bulletin No. 52. Texas Engineering Experiment Station, Agricultural and Mechanical College of Texas, College Station, Texas. Paper cover, 6 x 9 in. 45 pages. Available on request.*]

STEAM. This is the first paper in a series of three covering investigations on the determination of purity of steam. In it the authors discuss the mechanism of steam contamination and methods of measuring steam purity classified according to impurities present. Principally, however, the subject matter is devoted to the apparatus and procedure followed in making gravimetric determinations of the residue from evaporated samples of condensed steam with the results obtained. As a check on these analyses, estimates are made for solids in steam from turbine-blade deposits. The results of spectrographic analyses are also given. [*"Determination of the Purity of Steam by Gravimetric and Spectrographic Methods," by M. C. Schwartz, W. B. Gurney, and T. E. Crossan. Paper presented at the spring meeting, Worcester, Mass., of the ASME, May 1-3, 1940. For copies, write American Society of Mechanical Engineers, 29 West 39th Street, New York.*]

SMOKE PREVENTION. 1940 manual of ordinances and requirements in the interest of air pollution, smoke elimination and fuel combustion. Includes reprints of the papers read before the 34th annual convention of the Smoke Prevention Association. Among papers reprinted are ones on atmospheric corrosion, mechanical firing of solid coal, conical method of firing low volatile coal, and practical problems pertaining to effecting a smokeless installation of oil burning equipment. [*"Manual of Ordinances and Requirements, in the Interest of Air Pollution, Smoke Elimination, Fuel Combustion." Published under the auspices of the Smoke Prevention Association of America, Inc., 139 N. Clark St., Chicago, Ill. Paper cover; 6 x 9 in.; 160 pages Price, 60 cents.*]

NEWS OF THE MONTH

National Fire Protection Association Revises A.C. Standards; Warm Air Installation Rules Also Amended

BOSTON—Amendments to the National Fire Protection Association's Standards on Air Conditioning, offered by the Air Conditioning Committee at the Association's 44th annual meeting at Atlantic City, were unanimously adopted. Among the additions to the Standards is a section on smoke detectors which recommends use of these devices. The section which is now part of the standards is as follows:

"Effective means of detecting and controlling the spread of smoke in air conditioning systems is recommended in premises where the panic hazard is pronounced or where there are valuable contents particularly subject to smoke damage.

"Heat actuated devices are not effective for this purpose, under the usual conditions of air conditioning system operation. Photo-electric devices are now available which can be arranged to sound alarms, shut down fans, close dampers, actuate fire extinguishing equipment or perform other functions. Such devices project a light beam on a photo-electric cell, arranged to actuate equipment when the light is interrupted by smoke of a predetermined intensity. Such devices, when installed, should comply with the following provisions:

"(a) Devices and installation should be subject to the approval of the inspection department having jurisdiction.

"(b) Installation should be in accordance with the Standards on Central Station Protective Signaling Systems (current edition), or with the Standards on Proprietary, Auxiliary and Local Systems (current edition), depending upon class of service.

"(c) Devices should be located in the main supply duct on the downstream side of the filters, so located as to operate reliably in case of smoke in any part of the air stream.

"(d) Setting should be such as to operate reliably when any appreciable amount of smoke passes the unit.

"(e) Devices should be of such a type and so installed as to minimize the possibility of operation due to accumulation of dust, deterioration of the equipment, fluctuation in electric current supply or to any other condition in system operation not associated with fire or smoke.

"(f) Smoke detection equipment should incorporate suitable visual or audible signals to indicate any condition, such as failure of the light source or photo-electric cell, which would interfere with proper operation of the equipment.

"(g) Equipment should be frequently inspected and maintained in proper operative condition."

The section on automatic fire doors and dampers was revised to read as follows:

"Approved dampers shall be provided as follows:

"(a) Where duct systems serve two or more floors, approved fire dampers shall be required at each direct outlet or inlet and in each branch duct at its junction with the main vertical duct. Dampers are not required at room openings in the branch duct.

"(b) In systems of over 15,000 cu. ft. per minute capacity, serving areas where large numbers of people congregate, or having valuable contents particularly subject to smoke damage, it is recommended that approved smoke dampers be installed in the main supply duct and main return duct. Such dampers should be closed automatically by the operation of approved smoke detectors, or by manual control from readily accessible points in the areas served where acceptable to the inspection department having jurisdiction.

"(c) Dampers provided in ducts used solely for exhaust of air to the outside, shall be installed in such a way that they will not interfere with the flow of air in the main duct. No dampers are required in a system serving only one floor and used only for exhaust of air to the outside. Dampers should be designed to close in the direction of air flow. Where direction of exhaust air flow is upward, sub-ducts at least 22 inches in length may be carried up inside the main duct from each inlet, in lieu of dampers."

Other amendments cover construction and installation of ducts, air filters, controls and electric wiring.

A complete new text was approved for the standards on warm air heating and air conditioning systems in residences. These divide warm air systems into two types—(1) high temperature systems, defined as gravity warm air systems, systems that are hand-fired, systems that are automatically controlled with limit controls set above 200F and any systems not conforming with the requirements for low temperature systems, and (2) low temperature systems, defined as those using low pressure steam or hot water for air heating and automatically fired warm air furnaces equipped with a fan and with limit controls set to operate not higher than 200F.

The standards provide for minimum thicknesses of galvanized iron or the minimum weight of tin to be used for ducts. The following table summarizes these requirements.

Diameter, Inches	Minimum Weight of Tin	Minimum Thickness of Galvanized Iron, U.S. Gauge
DUCTS NOT ENCLOSED IN PARTITIONS		
ROUND DUCTS		
Less than 12	1C (107 lb.)	30
12 or more	1X (135 lb.)	28
RECTANGULAR DUCTS		
Less than 14	—	28
14 or more	—	26
DUCTS ENCLOSED IN PARTITIONS		
14 or less	1C (107 lb.)	30
Over 14	1X (135 lb.)	28

At the convention the Committee on Blower Systems reported that a meeting of the committee had been held in New York last winter and discussed some features of standards on blower systems which need revision, clarification or amplification, as follows:

"(a) Proper types of fan and drive assemblies for specific locations or stocks handled. A subcommittee will be appointed to assemble experience and other data and report to your committee later this year.

"(b) Amplification of sections having to do with fire extinguishment in ducts and apparatus, and possibilities of diverting fire to avoid unnecessary damage.

"(c) Possible revision of detail data on construction of small refuse or stock receptacles.

"(d) Information on dispersion or elimination of static electricity in dust clouds in ducts.

"(e) Inclusion of more specific data on explosion relief venting, most effective locations of collector hoods, and points of application of fire extinguishing medium, all by means of adequate sketches."

Plymouth Stresses Its Plant A.C.

DETROIT—Probably the first time air conditioning in connection with manufacturing has been mentioned as a sales point in connection with automobiles was at a meeting of 350 automobile editors at a preview of the 1941 Plymouth held here Aug. 15.

D. S. Eddins, president of Plymouth, in describing the features of the 1941 models, said that great stress has been laid upon extremely close adherence to tolerances in manufacture and on balancing operations which include the making of pistons in insulated, temperature-controlled rooms.

Congress Asks for Defense Housing

WASHINGTON—The National Defense Advisory Commission late in August asked Congress to authorize an expenditure up to $150,000,000 to provide housing for persons engaged in national defense activities, both in military and civilian life.

The request was transmitted to Speaker Bankhead in a letter from C. F. Palmer, Coordinator of Defense Housing, and an accompanying bill. Basically it would provide housing for persons engaged in national defense activities and their families "in areas in which the President shall find that an acute shortage of housing exists or impends which would impede national defense activities."

Under the terms of the bill the construction program would be in charge of the Federal Works Administrator, acting through the Public Buildings Administration. This official would receive the widest possible latitude in buying or accepting land and providing the proper housing for Army, Navy and civilian personnel.

Mr. Palmer's letter gave no details of where housing shortages have developed or might develop. The main idea behind the legislative request, as understood at the Capitol, is to prepare for any eventuality, and especially to avoid the type of housing situation which developed in many places in the World War days.

Stoker Group Committees Formed

CHICAGO—Frank Hoke, president of the Stoker Manufacturers Association, and vice-president of Holcomb & Hoke Mfg. Co., Indianapolis, has announced appointments of chairmen of standing committees for the ensuing year:

Advertising and Public Relations—J. M. McClintock, chairman, Illinois Iron & Bolt Co.; Business Standards Committee—A. D. Scoville, chairman, Cotta Transmission Corp.; Commercial Committee—B. O. Fink, chairman, Auburn Foundry, Inc.; Legislative Committee—R. C. Goddard, chairman, Combustioneer Div., Steel Products Engineering Co.; Engineering and Research Committee—E. C. Webb, chairman, Iron Fireman Mfg. Co.; Ways and Means Committee—J. E. Martin, chairman, Link-Belt Co.; Traffic Committee—C. J. Incrocci, chairman, Link-Belt Co.

Mr. Hoke heads the Executive Committee of the Association, which is an elective position and is also ex-officio member of each standing committee.

The first meeting of the new Engineering and Research Committee was held in Chicago August 12 at which time special consideration was given to two major problems: recent smoke abatement legislation and boilers for stoker firing.

Business Standards Are Adopted by Stoker Association

CHICAGO—For nearly a year the Stoker Manufacturers Association, through a special committee on business standards, has been working on a code of standard business practice which largely involved standards covering consumer and trade paper advertising for the small stoker industry. This committee, headed by C. T. Burg, general sales manager, Iron Fireman Mfg. Company, presented a complete and final report at the recent annual meeting of the Association which was officially approved and adopted. Others on Mr. Burg's committee are: C. E. Lewis, A. D. Scoville, and Stevens H. Hammond.

"In the preparation of these standards and in their adoption," Marc G. Bluth, Secretary of the Association, states, "very careful and serious consideration was given to past and current practices in the stoker industry with particular reference to advertising claims being made by the manufacturers in all consumer mediums and in trade papers. The establishment and adoption of these standards indicates a genuine desire on the part of the members of the Association to eliminate, insofar as possible, practices which are harmful both to the industry and the public."

In addition to the adoption of advertising standards, the code also recommends the adoption of a standard accounting practice manual for dealers "in order to assist the retail stoker industry in determining essential items of cost and as a guide for dealers in establishing sound and practical methods of cost accounting for the retail stoker business." In this connection, a special committee made up of the chief stoker auditors of three member companies of the Association have been delegated to study accounting practices of retail stoker dealers and to report to the Association as soon as possible with its recommendations as to a simplified accounting practice manual which can be easily adopted and put into effect by retail stoker dealers.

The Code also established a standard warranty on stokers and stoker parts, as well as a standard service guarantee.

Armour Tech and Lewis Merged

CHICAGO—On July 24 the Illinois Institute of Technology was created through the merger of Armour Institute of Technology and Lewis Institute. Henry T. Heald, for the past two years president of Armour, has been elected president of the newly formed institute.

A.C. Contests Planned for Shoppers

BUFFALO—"Why Do You Like to Shop in an Air Conditioned Store?" Hundreds of Buffalo shoppers are now busy answering this question following the opening of an essay contest sponsored by the Air Conditioning Council of Western New York in cooperation with more than 100 air conditioned stores and other business establishments in Buffalo.

Fifty-six prizes will be awarded for the best answers to this question. The first prize is $75 in merchandise which must be purchased in one of the participating stores. The other prizes also are merchandise purchase certificates. The contest close October 5.

More than 300 posters announcing the contest were distributed in the air conditioned establishments with some business houses taking three or four posters. Twenty-two inches high and fourteen inches wide, the posters announced that this business establishment had installed air conditioning for comfort, efficiency and health by a member of the Air Conditioning Council of Western New York.

Attached to each poster is a pocket which contains entry blanks for the essay contest. This is the only place where the entry blanks can be obtained. This had particular appeal for the stores since it brought prospective contest entrants into their establishments.

Assisting in the pre-contest build up were announcements of the events three times a week on the Breakfast Club radio program. Department stores, apparel shops, bakeries, candy shops and other air conditioned business establishments participated.

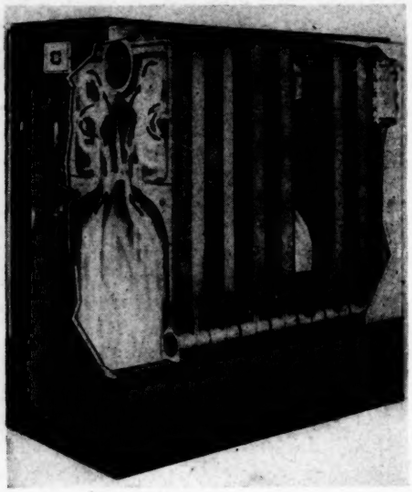
According to Walter P. Davis, executive secretary of the Air Conditioning Council, this contest is expected to stimulate a much greater interest in summer air conditioning both on the part of the buying public and the stores themselves. Stores without air conditioning will be conspicuously absent from the contest. Stores with air conditioning are extremely interested because the contest should swell traffic in their aisles and help sales through the merchandise prize buying, Mr. Davis declared.

In writing his answer to the contest question, the entrant also must list five business establishments he patronizes and which feature air conditioning. This also serves to make the entrant more air conditioning conscious.

H. G. Matthiessen

NEW YORK—H. G. Matthiessen, who had been assistant chief engineer of Typhoon Air Conditioning Co., Inc., for the past 20 years, died Aug. 14.

NEW EQUIPMENT



Smith Mills "25" Boiler

Smith-Mills Heating Boiler

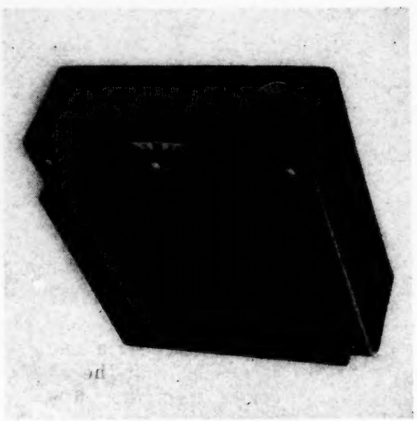
NAME—Smith-Mills "25" boiler.
PURPOSE—For supplying steam or hot water using oil, stoker or hand-fired coal.
FEATURES—Boiler is designed for such buildings as roadside restaurants, monitor stores, garages, small public buildings, and large residences. It is a jacketed sectional boiler with castings made of grey iron. Manufacturer states that gas travel is vertical and lateral as well as horizontal to insure maximum surface contact and high efficiency. Fins have been placed where gases are hottest to provide additional absorption. Provision is made for all necessary controls and a built-in trombone type tank or tankless heater is optional equipment.
CAPACITIES—From 1300 to 2300 sq. ft. standing steam radiator surface.
MADE BY—*The H. B. Smith Company, Incorporated, Westfield, Mass.*

M-H Unit Heater Control System

NAME—M-H unit heater control system.
PURPOSE—For controlling the operation of unit heaters.
FEATURES—System may be either pneumatic or electric. The system is said to provide (1) modulated continuous flow of steam whenever the thermostat is calling for heat, the quantity of steam flow being dependent on the demands of the thermostat, (2) continuous automatic fan operation only when steam is being supplied to the unit heater, (3) manual on and off switch, (4) (optional) a means of automatically shutting off fan when there is no steam pressure in the main steam line.
MADE BY — *Minneapolis-Honeywell Regulator Company, 2950 Fourth Ave., South, Minneapolis, Minn.*

Young Unit Heater

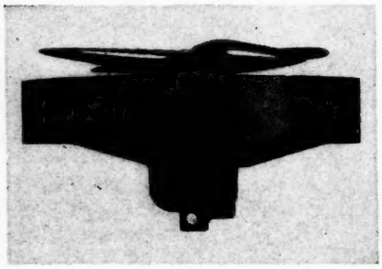
NAME—Vertiflow unit heater.
PURPOSE — For heating industrial buildings, stores, and similar structures having high ceilings.
FEATURES—These units may be installed high above the floor and are said to eliminate any possibility of air stratification and to assure little difference between the floor and ceiling temperatures.
SIZES & CAPACITIES—12 sizes with capacities from 63,000 to 480,000 B.t.u. per hr.
MADE BY—*Young Radiator Company, Racine, Wis.*



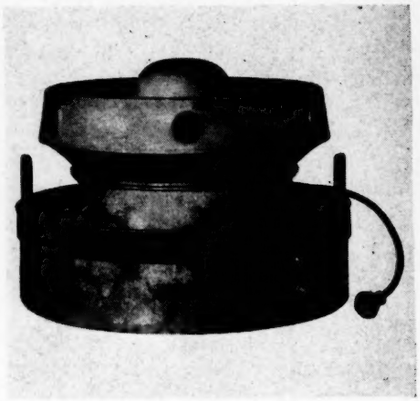
Young Vertiflow Unit Heater.

Truflo Roof Ventilating Fans

NAME—Truflo roof ventilating fans.
PURPOSE—For applications where it is necessary to increase air removal in gravity-type ventilators or where wind velocity is not sufficient to ventilate building.
FEATURES—These power driven fans are equipped with cast aluminum alloy fan blades and are mounted in steel bands as illustrated. Motors can be had in open, totally enclosed non-fan cooled, totally enclosed fan cooled, and explosion proof types.
SIZES AND CAPACITIES—Six sizes from 18 to 48 in., with capacities from 2,000 to 40,000 c.f.m.
LITERATURE AVAILABLE—Bulletin No. 240.
MADE BY—*Truflo Fan Company, 522 Main St., Harmony, Pa.*



Power Roof Ventilating Fans.



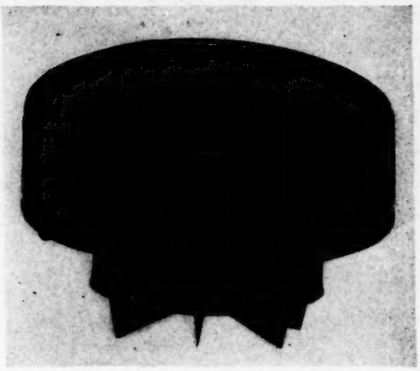
For industrial dehumidification.

Walton Industrial Humidifier

NAME—Walton industrial humidifier.
PURPOSE—For adding moisture to air in industrial buildings.
FEATURES—Humidifier is furnished complete ready for installation and requires only a connection to a water main and to an electric socket. Unit uses no heating coils and is equipped with an atomizing unit driven by an electric motor drawing approximately 100 watts. Tank is of heavy gage copper, 18 in. diameter and equipped with an adjustable float valve and overflow outlet complete with hanging brackets. Vapor is discharged horizontally through six flared holes and the unit is said to evaporize approximately 1 gal. per hr. Overall dimensions are 18 in. diameter, 14 in. high.
MADE BY—*Walton Laboratories Inc., 1186 Grove St., Irvington, N. J.*

White Thermostat

NAME—Master thermostat, type A 23.
PURPOSE—For control of room temperatures.
FEATURES — Polarized snap-action which is said to be entirely new principle in thermostat design is employed which together with a sensitive bi-metal blade is claimed to guarantee a minimum temperature differential. Instruments are set for a .5F differential and the manufacturer states that this differential is so small that no artificial heat is necessary to improve the sensitivity of the instrument. A mechanical snap-action which is said to eliminate chattering and arcing at the contacts together with a transparent shield which covers the contacts and protects them from dust is said to result in an instrument which functions for years on the same differential. Thermostat is designed with a range from 55 to 95F although it can also be furnished with a range as low as 35 to 75F.
MADE BY—*The White Manufacturing Company, 2362 University Avenue, St. Paul, Minn.*



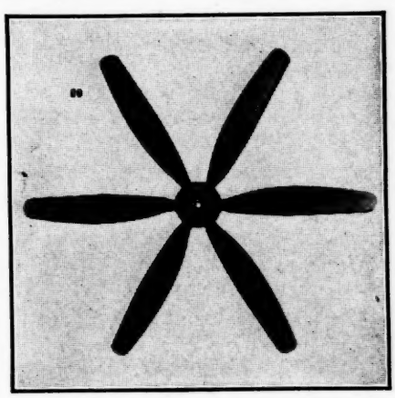
American Blower vertical heater.

American Blower Unit Heater

NAME — American Blower vertical heater.
PURPOSE — For supplying heat for either high or low ceiling applications in commercial or industrial establishments.
FEATURES—Heating elements are designed to operate on steam pressures up to 150 lb. per sq. in. Units are supplied with either constant speed, two-speed, or variable speed motors having a low speed approximately 50 per cent synchronous speed.
SIZES—Twelve sizes with capacity ranging from 30,000 to 600,000 B.t.u. per hr. with 2 lb. steam and 60F entering air.
LITERATURE AVAILABLE—Bulletin A 9158.
MADE BY—*American Blower Corporation. Div. American Radiator and Standard Sanitary Corp., 6000 Russell Street, Detroit, Mich.*

Hartzell Adjustable Pitch Fan

NAME—Adjustable-pitch cooling tower fan.
PURPOSE—For supplying air to cooling towers.
FEATURES — This fan is equipped with a propeller incorporating the features of the patented "tear-drop" blade which is said to permit the high speed air movement of the propeller type blade at tip speeds well below the requirements for quiet operation. The manufacturer states that since the blades are used in conjunction with a variable pitch hub which allows the use of from 3 to 12 blades and at the same time permits variation in pitch to give the proper amount of air, this fan is an ideal cooling tower fan. The blade is made of cast and machined aluminum alloy and the blade adjustment is said to be extremely easy. This fan is also equipped with a Charavay air-seal ring which is said to eliminate back flow of air at the propeller tips and thereby increases effective air delivery by 20% or more.
SIZES—36 to 130 in. diameter. Other sizes to order.
MADE BY — *Hartzell Propeller Fan Company, Piqua, Ohio.*



For cooling tower use.

Barber-Colman Motor Relay

NAME—Motorelay.
PURPOSE—For use in floating or proportioning control circuits of line voltage motors operating large dampers, large valves, voltage regulators and similar equipment.
FEATURES—The relay consists of a small reversible geared head, shaded pole Bar-col motor which tilts two mercury tubes. The tubes are arranged to give single pole, double throw operation with spring return to a neutral off position. It is said that the use of this relay permits throttling, floating or proportioning control of a 5-ampere load from a sensitive instrument having a current rating as low as 0.35 ampere. It is claimed that chattering is eliminated by the use of the motor relay because a momentary contact at the instrument is not sufficient to close the mercury tube switch.
MADE BY—*Barber-Colman Company, Rockford, Ill.*

Alfol Radiator Reflectors

NAME—Alfol radiator reflector.
PURPOSE — For reducing heat loss from buildings by reflecting the heat from radiators back into the room.
FEATURES—This aluminum foil insulation is designed to be installed behind radiators and to reflect the heat from the radiator back into the room. The material is furnished in rolls 26 in. wide containing 71 sq. ft. of 0.001 thick Alfol. To install this material it is only necessary to cut sufficient material to fit behind each radiator. Before placing it behind the radiator, it is crumpled slightly with the hands and pulled out again. This is said to remove the metallic rattle of the material and give it additional strength to stand in place. Manufacturer states that enough material is contained in each roll to service ten average size radiators.
LIST PRICE—$5.00 per roll.
MADE BY—*Alfol Insulation Co., Inc., 155 East 44th Street, New York, N. Y.*

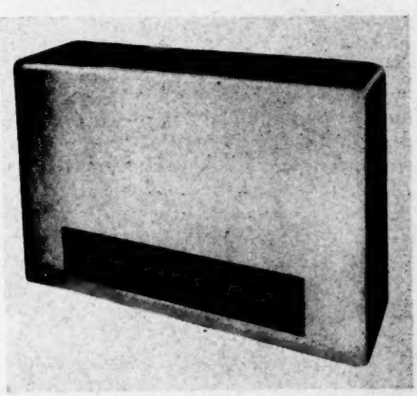
Industrial Humidistat.

Friez Insertion Humidity Control

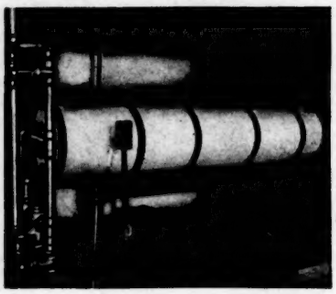
NAME—Industrial insertion humidistat, type H61.
PURPOSE—For insertion in ducts or cabinets where dust, dirt, or other adverse service conditions would prevent satisfactory service of other types.
FEATURES—Control features the multiple human hair element and a switch mechanism, fully enclosed in a molded plastic case. Controls humidifying and dehumidifying over a range of 10 to 100 percent relative humidity within plus or minus 1 percent.
MADE BY — *Julien P. Friez & Sons, Div. of Bendix Aviation Corp., Baltimore, Md.*

Trane Convectors

NAME—Trane Force-Flo convectors.
PURPOSE—For heating entrances.
FEATURES—Lobbies, all types of entrance halls and stairways are a few of the locations where these convectors are applicable. Convector is available in two floor type units, one wall and one ceiling type. They incorporate Trane heating coil and blower. Three control arrangements are available—constant, two, and multi-speed. The two-speed control which is standard is mounted in the end of the cabinet, thus eliminating the need for separate control mounting.
MADE BY—*The Trane Company, LaCrosse, Wis.*



For heating building entrances.



For large quantities of hot water.

Taco Tankless Water Heater

NAME—Flo-Line Tankless Taco.
PURPOSE—For heating large volumes of domestic hot water.
FEATURES — This heater is offered for buildings requiring large volumes of domestic hot water during heavy peak demand periods. While similar to the Hi-Flo Tankless Taco in construction, it is installed entirely below the boiler line. A Taco circulator controlled by an electric aquastat is provided to insure a rapid transfer of heat from boiler water to domestic hot water. During periods of no draw when the circulator is not operating, the boiler water circulates through the heater by gravity through a "gravity by-pass". This check valve closes when the circulator operates to prevent short circuit. The heater is designed so that the domestic water comes in contact only with bronze and copper.
SIZES & CAPACITIES—From 340 to 1660 gal. per hr., 40F to 140F with boiler water at 180F.
MADE BY — *Taco Heaters, Inc., 342 Madison Ave., New York. N. Y.*

Sterling Float and Thermostatic Trap

NAME—Sterlco float and thermostatic trap.
PURPOSE — For separating air and water from steam.
FEATURES—These traps have recently been redesigned and are said to have greatly increased capacity ranges. They incorporate combined float and bellows and are said to be suitable for all steam conditions from 25 in. vacuum to 20 lbs. pressure. Air is vented continuously by means of a bellows-controlled valve near the top of the trap. A separate water outlet is controlled by a copper float in the trap body. Two inlets on the side and top and two outlets on the side and bottom permit assembly into the line in a number of different pipe arrangements. Removal of four screws permits access to the operating parts without removing the trap from the line.
CAPACITY — 400 lbs. of water per hour at 2 lbs. steam pressure and 1200 lbs. at 20 lbs. pressure.
MADE BY—*Sterling Inc., 3732 N. Holton Street, Milwaukee, Wis.*

Sterlco Trap.

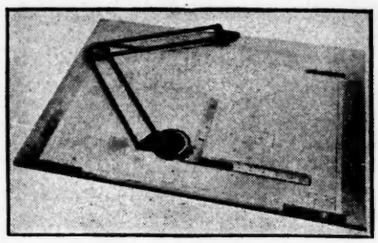
For room cooling.

Standard Stoker Corporation Air Conditioning Unit

NAME—Standard Conditioneer.
PURPOSE—For room cooling.
FEATURES—These units are said to be designed so as to obtain the maximum capacity available contingent with efficient condensing unit motor operation. Unit is said to clean, dehumidify, cool, and circulate air. It is housed in a metal cabinet covered with a burnt mahogany leatherette. Floor models are provided with thermostatic control and room air exhaust.
SIZES AND CAPACITIES—Two window units, 1/3 and 1/2 hp.; two floor units, 1/2 and 3/4 hp.
MADE BY—*Standard Stoker Corp., Inc., New Albany, Ind.*

Wright Drafting Machine

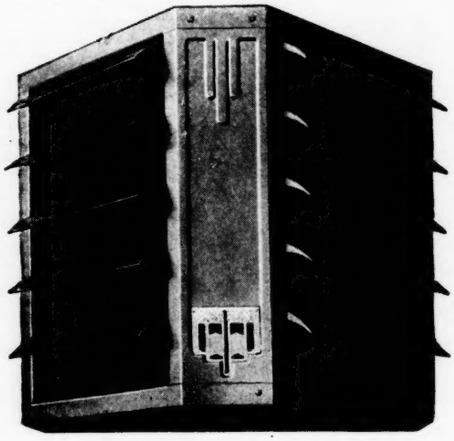
NAME—Wrigraph Industro drafter.
PURPOSE — A drafting machine for mounting on drawing boards up to 2 in. thick and 36 in. wide.
FEATURES — This is an adjustable ball bearing drawing machine for drawings up to 24 by 36 in. Machine has a hinged mounting permitting it to be raised clear of the board. A levelling screw is provided to adjust the machine to the plane of the drawing board. The protractor head is controlled with the left hand and features a no-set-zero. A ½ degree vernier equipped with a magnifier provides for a quick and accurate setting of all angles. Transparent edge, engine divided scales are available in all standard graduations. While the larger sizes of this machine are designed for mounting on boards up to 36 in., extension clamps are available for mounting the machine on wider boards.
SIZES—Four standard sizes, the largest covering a drawing area of 24 by 36 in. List price $22.75, complete with one set of scales.
MADE BY—*L. G. Wright, Incorporated, 5209 Euclid Ave., Cleveland, Ohio.*



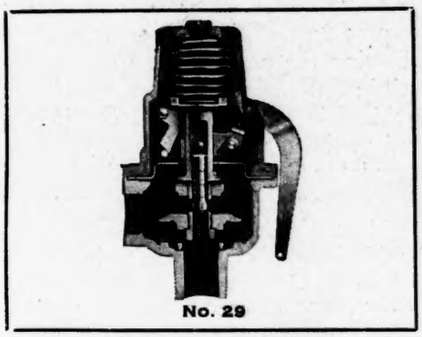
Wrigraph Industro Drafter.

Kisco Heat Recirculator

NAME—V-Type "Q-T" heat recirculator.
PURPOSE — A large capacity unit heater designed especially for installations in large spaces such as warehouses, garages, auditoriums and like buildings.
FEATURES — Instead of a single warm air stream, this unit heater projects two streams of heated air at right angles to each other. Manufacturer states that one unit thus accomplishes the work of two ordinary units. Only one motor, one fan, and one inlet and outlet connection are employed. Manufacturer claims especially quiet operation due to specially designed over-lapping fan blades and resilient rubber mounting.
MADE BY—*Kisco Company, Inc., St. Louis, Mo.*



Projects two streams of heated air.



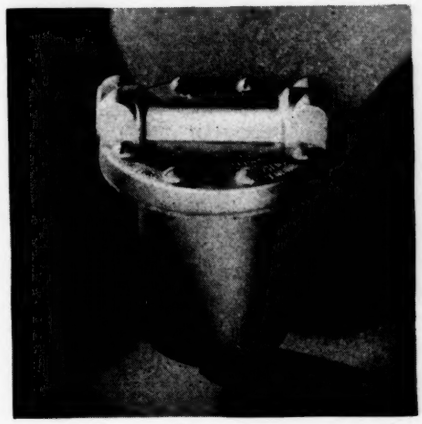
Hot water relief valve.

McDonnell & Miller Safety Valve

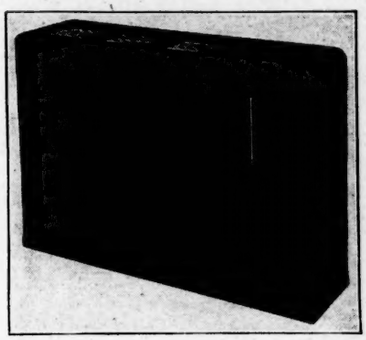
NAME—No. 29 safety valve.
PURPOSE—For relieving pressure in hot water systems.
FEATURES—Valve is known as the No. 29 safety valve and is named for its relief point of 29 lb. Manufacturer states that it is designed so that it will snap open to its full orifice capacity when the relief point of 29 lb. is reached. It is said to discharge its full capacity until the boiler pressure is reduced to 22 lb., at which time it snaps to instantaneous closure. Other features include hardened stainless steel valve with metal-to-metal seal above the cone to protect working parts when valve is discharging and factory adjustment which is said to prevent tampering. Valve is fully A.S.M.E. approved.
MADE BY—*McDonnell & Miller, Wrigley Building, Chicago, Ill.*

Automatic Product's Oil Trap

NAME AND MODEL NUMBER—"Trap-It," Model 243.
PURPOSE—For removing dirt and water from fuel oil.
FEATURES—The filtering element in this trap consists of a honey-comb filter tube, constructed by winding coarse cotton yarn of soft texture around an open metal supporting core. The filter element is held in place by a centering cup and non-corrosive spring. The cover is constructed of zinc die casting which is tested against a pressure of 100 lbs. per sq. in. A drain plug is provided at the bottom of the unit so that the sediment and water can be easily removed. The unit is rated at 5 gallons per hour for No. 3 or lighter oil.
MADE BY—*Automatic Products Co., 2450 North 32nd St., Milwaukee, Wis.*



Removes dirt and water from fuel oil.



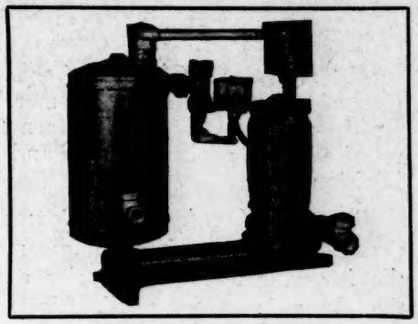
DeLuxe hiJet heater.

Herman Nelson hiJet Heater

NAME—DeLuxe hiJet heater.
PURPOSE—For heating stores, offices, churches, or similar buildings, using steam or hot water as a heating medium.
FEATURES—In operation air is drawn through the recirculating grille into the unit through the heating element and filter and is then discharged into the room through the discharge grille. Motor driving the fan is located in the compartment out of the air stream which construction is said to allow the full utilization of the suction chamber for the housing of larger fans, which in turn is said to lower tip speeds. Cabinet is furnished in brown baked enamel. Unit may be mounted on the floor, placed on the wall or suspended from the ceiling and may be arranged to discharge upward, downward or horizontally.
SIZES—Six sizes with capacities from 24,800 to 145,200 B.t.u. per hr.
MADE BY—*The Herman Nelson Corporation, Moline, Ill.*

Johnson Boiler Feed Pump

NAME & MODEL NO.—Boiler feed pump 30SH.
PURPOSE—For returning feed water to boilers.
FEATURES—This is said to be a small and less expensive model of the Johnson pump which is used in large power plants and heating plants. It consists of a cylindrical receiving chamber and a vertical close coupled centrifugal pump mounted on a cast iron base. This base has a pipe cast integrally which connects the receiver to the pump suction. Stationary electrodes are suspended into the top of the receiver and control a solenoid operated valve which is mounted between the pump and the receiver. The pump utilizes the pressure equalizing principle of boiler feeding. Manufacturer states that the pump will handle condensate as hot as 300F without danger of vapor binding.
SIZES & CAPACITIES—10 gal. per min. and suitable for boilers up to 30 hp.
MADE BY—*Johnson Corp., Three Rivers, Mich.*



For returning condensate.

Hays Air Filter Gage

NAME—Hays air-filter gage, series B.
PURPOSE—For indicating static pressure drop across filters.
FEATURES—Gage is designed to be connected to static tips installed in the duct on opposite sides of the filter bank. The difference in static pressure between the two tips is indicated by the gage. The gage may be furnished with electric contacts so as to flash or sound an alarm when resistance becomes excessive, or to operate a damper to control the flow of air through the ducts. Standard scale ranges are .3, .5, 1, 1.5, 2 and 5 in. water. Special ranges also available. Gages available for wall or flush panel mounting.
MADE BY—*The Hays Corporation, Michigan City, Indiana.*

For indicating air filter resistance.

WITH THE MANUFACTURERS

Airtemp Div., Chrysler Corp., Detroit, has appointed *Ward H. Barnett* as merchandising manager. In his new assignment, Mr. Barnett will promote and coordinate the air conditioning and heating sales of the Division.

Brunner Manufacturing Company, Utica, N. Y., through *B. J. Scholl,* sales manager, announces the following transfers of sales representatives, effective July 1: *George W. Mathews,* who formerly covered the Detroit area, will take over the Chicago territory, which has been vacated due to the resignation of R. E. Mercer. Mr. Mathews will cover the upper part of Illinois and the southern part of Wisconsin, with headquarters in Chicago. Mr. Mathews has been active in commercial refrigeration for more than 20 years. Before joining Brunner two years ago, he was associated with Baker Ice Machine Company, Lincoln Refrigerating Corporation, and with the Lester U. Larkin Company. *H. S. Dekker* will succeed Mr. Mathews in the Detroit territory, covering Michigan, upper Indiana and part of Ohio. Mr. Dekker formerly covered the southern territory of Tennessee, Alabama and Mississippi, with headquarters in Memphis. Prior to joining the Brunner organizaton, Mr. Dekker's previous experience was with the Kelvinator Company, Brunswick-Balke-Callender Company, Electrimatic Corporation and F. H. Lansenkamp Company. His headquarters will be in Detroit. The territory formerly covered by Mr. Dekker will be added to the present territory of *H. T. Noone,* whose headquarters are in Atlanta, Ga. In addition to covering the six southern states, Mr. Noone will have under his jurisdiction the Brunner warehouses in Atlanta and Memphis. He has been with the Brunner organization for a little over two years. Previously Mr. Noone was associated with the Worthington Pump and Machinery Corporation, General Electric Company and Brunswick Refrigeration Company.

DeBothezat Ventilating Equipment Division, American Machine and Metals, Inc., East Moline, Ill., has appointed *Walter C. Davis* to cover the Maryland and District of Columbia territory, with headquarters at Baltimore.

General Controls Co., Glendale, Calif., manufacturer of pressure, temperature and flow controls, announces a change in address of its Kansas City office to 421 Southwest Boulevard. The office is in charge of *E. V. Bialik,* sales manager.

Perfex Corporation, Milwaukee, Wis., announces that *George Kingsland* has been appointed vice-president in charge of eastern sales for that company covering the territories east of Pittsburgh and Buffalo. Mr. Kingsland, who is particularly well known in the heating industry, late in 1920 opened a manufacturer's agency in St. Louis under the firm name of Kingsland-Rawlings, Inc., handling the Minneapolis Heat Regulator line in that city. In February, 1925, he joined the Minneapolis Heat Regulator Co., and founded its St. Louis branch. In July, 1925, he opened the Boston office for Minneapolis Heat Regulator Co., taking over the territory formerly covered by the S. L. Prentis Co., New England distributors for Minneapolis. At that time he was elected resident vice-president of the Minneapolis Heat Regulator Co. Following the consolidation of Minneapolis and Honeywell in 1927, Mr. Kingsland continued as resident vice-president in Boston and in December, 1930, was transferred to the home office of the Minneapolis-Honeywell Regulator Co. in charge of the Modutrol Division, which he organized; at the same time he was elected vice-president of the company. Following the purchase of the National Regulator Co. by Minneapolis-Honeywell he was also manager of the pneumatic control factory in Chicago. He resigned from Minneapolis-Honeywell Regulator Co. in December, 1939.

Penn Boiler and Burner Mfg. Corporation, Lancaster, Pa., has appointed *A. L. Frank* as southern sales manager; *A. H. Townsend* to be in charge of the Philadelphia territory; and *C. M. Spanger* in charge of the New England territory.

Plandaire, Inc., Pittsburgh, Pa., has announced the appointment of *Clifford R. Hutcheon* as chief engineer. Mr. Hutcheon was formerly with the Anemostat Corporation of America. He will be in complete charge of production, research and development.

Whiting Corporation, Harvey, Ill., has taken over the manufacture and sale of Butler stokers. The negotiations were completed during the latter part of June by *Stevens H. Hammond,* vice president of Whiting Corporation, and *W. B. Hughes,* manager of the stoker division of the Butler Manufacturing Company, Kansas City, Missouri. Mr. Hughes, in a statement to Butler dealers and distributors announcing the transfer of Butler to Whiting, informed them that Butler found it necessary to withdraw from the stoker industry due to its other lines requiring so much of its production and selling effort, that the Whiting association assured Butler dealers of a continued source of supply of Butler stokers, parts, and service, and that the Butler stoker would in no sense become an "orphan."

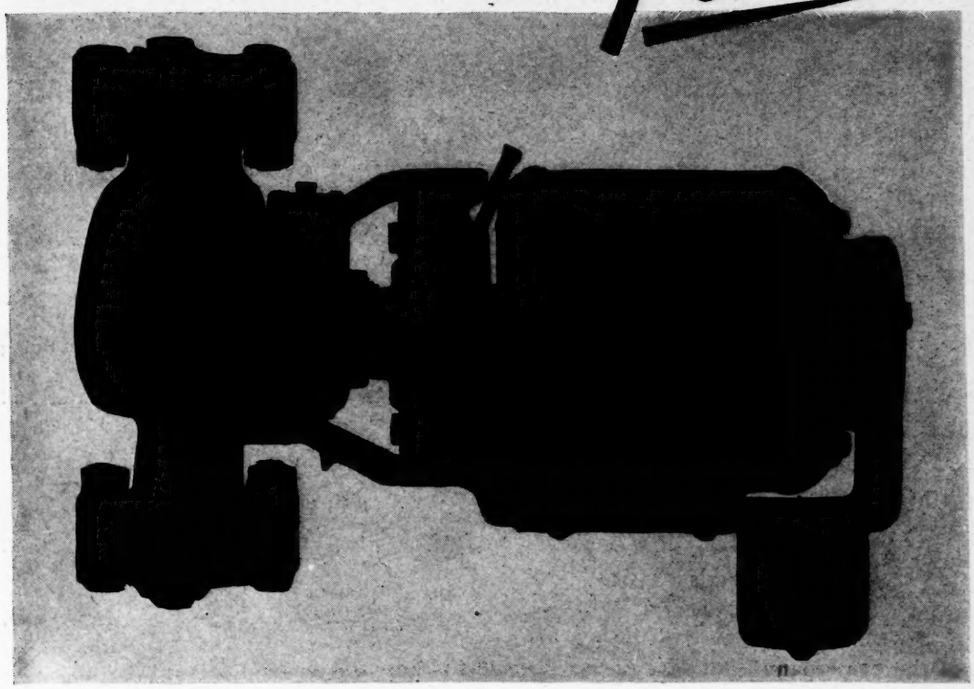
Glenn H. Henry, for the past six years service manager in the stoker division of Butler, has joined Whiting as stoker service manager.

William F. Tilley, who entered the stoker industry in 1928 and joined Whiting's stoker division in 1935 as service manager, has been appointed as assistant to the sales manager.

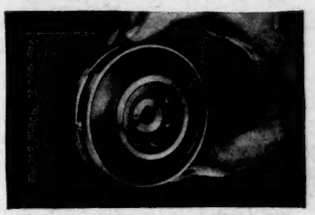
Young Radiator Company, Racine, Wis., has appointed *Atwell D. Lynch* as director of personnel. The company has also appointed three new representatives as follows: *Portland Engineering Co.,* American Bank Building, Portland, Ore.; *R. M. Scott,* 417 Market St., San Francisco, Cal., and *I. E. Danford,* Caldwell, Ohio.

York Oil Burner Co., Inc., York, Pa., has appointed *H. M. Carpenter* Domestic Service Manager of the company. Mr. Carpenter, associated with the heating industry for more than 13 years, has been a member of York's engineering staff since December 1939. At one time he had conducted his own heating and service organization and previously was in charge of engineering, installation and service for a large dealer.

ONLY THE B&G BOOSTER HAS ALL THESE *Plus* FEATURES



Watertight seal eliminates stuffing box—prevents entry of water into the bearings.



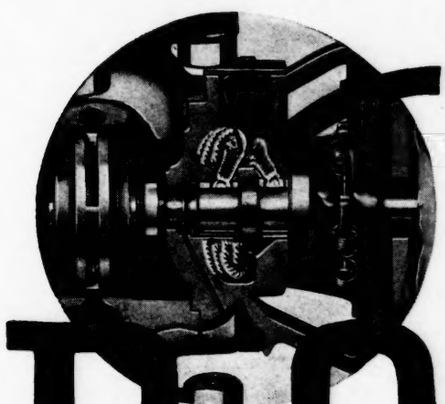
Forged navy brass impeller is balanced. Close clearances prevent water slippage.

The shaft—highly polished hardened machine steel. Costs six to eight times as much as ordinary shafting.

Easily separated into three sections—all working parts easily accessible.

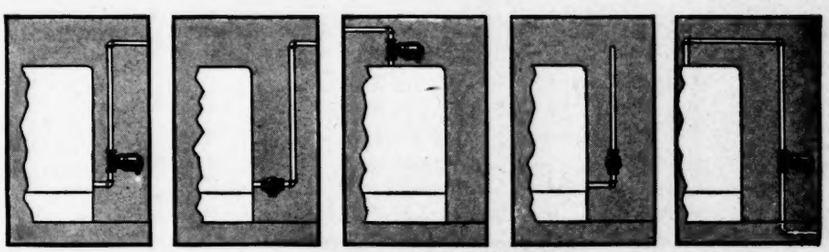
This is the pump with the built-in extra quality which *gives* service without *requiring* it! For forced hot water heating systems and for circulating service water it has proved its utter dependability.

In design, the B & G Booster has every characteristic which is an inherent assurance of satisfactory operation. In materials and workmanship, nothing but the finest. It is built as a horizontal-drive unit for sound engineering reasons . . . reasons which are demonstrating their practical value in the thousands of installations now in operation. This construction makes possible many of the desirable features found exclusively in the B & G Booster.



CIRCULATING OIL LUBRICATION

No pump is better than its oiling system. Therein is one reason for Booster superiority. *It is lubricated by a genuine oil-circulating system!* Oil is drawn up by wool fibre wicking and dropped on the horizontal bearing surfaces. A few drops of medium grade motor oil at infrequent intervals keeps the Booster in perfect running order.



EASIER TO INSTALL

The B & G Booster can be installed in many different positions—a great convenience feature. The fact that it can be installed in an *upright pipe* has many advantages. It can be placed high enough to avoid the hazard of a flooded basement; sediment and sludge cannot accumulate and no pocket of water is left to freeze when the system is drained.

B&G

ASK YOUR REGULAR WHOLESALER

BELL & GOSSETT CO.

3000 WALLACE ST., CHICAGO

Canadian Licensee: S. A. Armstrong, Ltd., 720 Bathurst St., Toronto, Canada

NEW TRADE LITERATURE

Air Conditioning. A standard size, 24-page bulletin describing and illustrating installations of Frick air conditioning and refrigeration which have been made in Baltimore and the south by Paul J. Vincent Company. FRICK COMPANY, INC., Waynesboro, Pa.

Air Filters. A standard size, 16-page bulletin, 250-C, describing the self-cleaning Electro-Matic air filter Model C. Diagrams and cut-away sections are included to show how electrical precipitation and automatic filtration have been combined in a compact, self-contained unit which requires no outside electrical connections other than a 110-volt alternating current lighting circuit. Also lists typical installations, gives engineering data, suggested specifications, installation information and capacity and dimensional data. AMERICAN AIR FILTER COMPANY, Louisville, Ky.

Air Filters. A standard size 18-page catalog, GPC-740 on Air-Maze air filter panels. Gives information on four types of filter panels, industrial A, industrial B, Kleenflo and Greastop. Also gives information on how to clean these panels, how they are installed, and shows some typical installations. AIR-MAZE CORPORATION, 5200 Harvard Ave., Cleveland, Ohio.

Fans. Two bulletins on the New York blower type ME centrifugal fans. Both bulletins are standard size and give information on performance. The first has 16 pages, covers slow speed wheels and includes information on capacities and engineering data. The second bulletin has 24 pages and gives capacity information on high speed wheel centrifugal fans. THE NEW YORK BLOWER COMPANY, 32nd Street and Shields Ave., Chicago, Ill.

Fan Wheels. A standard size, 80-page catalog, illustrating the complete line of Castalu fan wheels. Includes many performance charts and tables showing capacities at various speeds and static pressures. A new scroll layout which can be used to lay out the housing for any size fan, is included in the catalog. Applications of standard makes of flexible couplings are also included and the catalog describes how the hubs on these fans can be supplied to fit the various types of flexible couplings. ADVANCE ALUMINUM CASTINGS CORPORATION, 2742 West 36th Place, Chicago, Ill.

Heating Coils. A standard size, 52-page catalog AC 601 on Fedders type K heating coils. Gives information on the construction, design features, dimensions, weights and capacities of type K coils. Capacity tables occupy 24 pages of the catalog. Of particular note are four time saver charts which have been especially developed for the rapid determination of temperature rises, coil types, face area, number of rows deep, and similar information needed by men who design large heating systems. Other information of value to designing engineers includes examples of how heating coils are selected, notes on the application of K coils, steam and condensate piping, diagrams, and such data as air volume conversion constants, air temperature rise conversion constants, air friction data, and capacities of steam supply and condensate return mains. FEDDERS MANUFACTURING CO., INC., Heating Division, Buffalo, N. Y.

Motors. A four-page standard size bulletin on Leland oil burner motors. Bulletin points out how these motors are engineered for dependability, quietness and appearance. Also gives specifications and dimensions. THE LELAND ELECTRIC CO., Dayton, Ohio.

Temperature Regulators. A standard size, 16-page catalog No. 52, covering the Sarco line of self-operated temperature regulators for controlling the flow of steam, gas, water or brine. Bulletin includes information on several new types which have been recently added to the line. A special feature is complete capacity tables for several different type valve styles to meet control problems in connection with industrial process work, water heating, air conditioning, and refrigeration. SARCO COMPANY, INC., 183 Madison Ave., New York, N. Y.

H&V'S PHOTOS

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Page 21—Hill and Knowlton.
Page 22 (upper left)—Hill and Knowlton. (middle) Boeing Aircraft Company. (lower left) Hill and Knowlton.
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COMING EVENTS

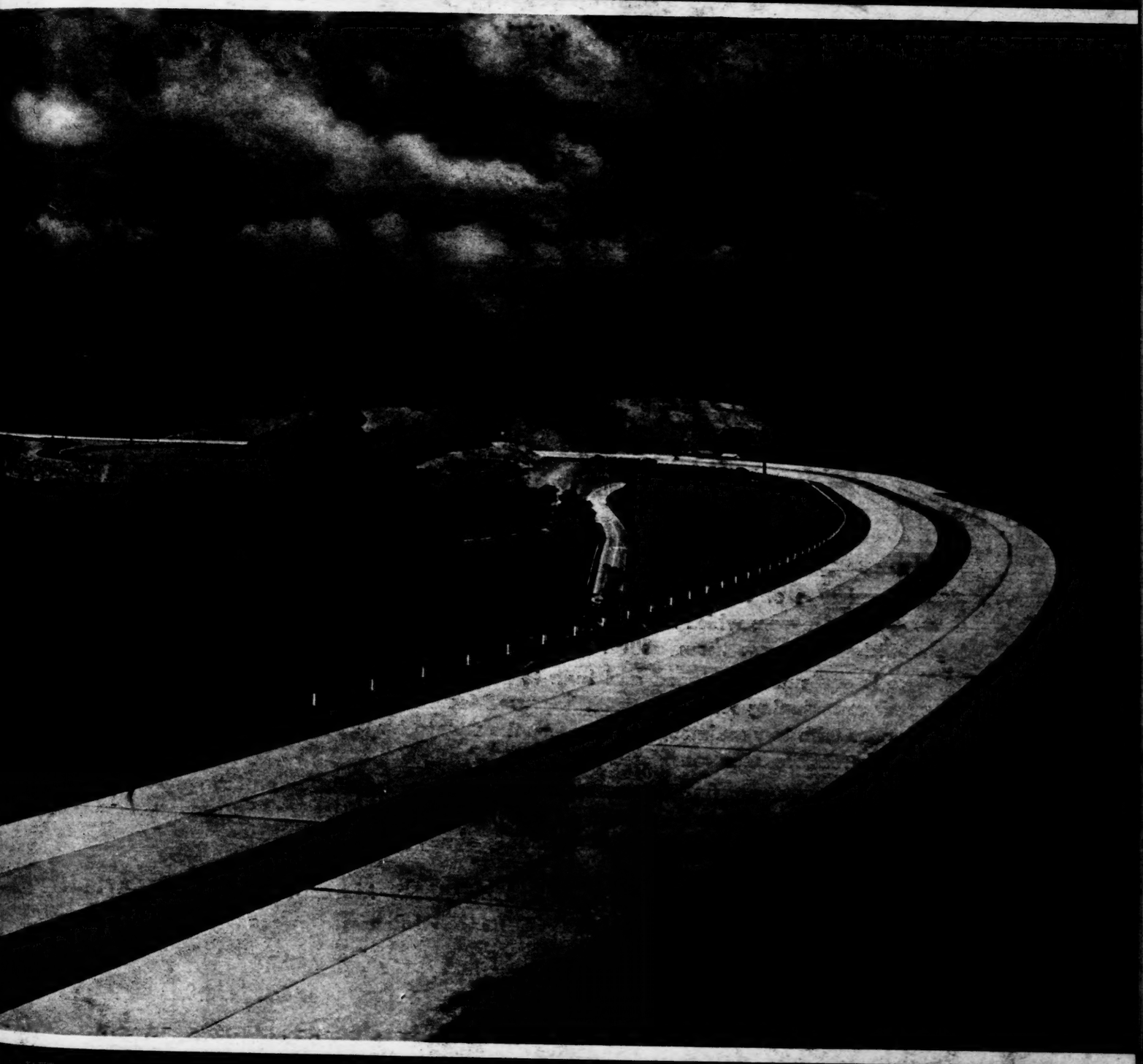
SEPTEMBER 18-20. 18th National Industrial Advertisers Association Exposition to be held at Hotel Statler, Detroit, Mich.

OCTOBER 7-10. 22nd Annual Convention of the American Gas Association, to be held at The Hotel Traymore, Ritz-Carlton Hotel, Hotel Ambassador and the Atlantic City Auditorium at Atlantic City, N. J. Managing Director, Alexander Forward.

OCTOBER 8-11. The 69th annual meeting of the American Public Health Association, Detroit, Book-Cadillac Hotel, Headquarters.

OCTOBER 14-15. Fall Meeting of the Houston ASHVE at Houston, Texas, to be held under the auspices of the South Texas Chapter and with the North Texas Chapter Members cooperating.

DECEMBER 2-7. 14th National Exposition of Power and Mechanical Engineering at the Grand Central Palace, New York, N. Y. For information write National Exposition Co., Grand Central Palace, New York, N. Y.

JANUARY 13-16, 1941. Third Refrigeration and Air Conditioning Exposition to be held at Stevens Hotel, Chicago.

JANUARY 27-29, 1941. 47th Annual Meeting of the American Society of Heating and Ventilating Engineers to be held at Hotel Muehlbach, Kansas City, Missouri, with Kansas City as Host Chapter.